Federation of Rhodesia and Nyasaland

REPORT

of the SECRETARY to the FEDERAL MINISTRY OF AGRICULTURE

For the Year Ended 30th September, 1959

Presented to the Federal Assembly
1960

Price 10/6 per copy

PRINTED BY THE GOVERNMENT PRINTER, SALISBURY
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REPORT OF THE SECRETARY TO THE FEDERAL MINISTRY OF AGRICULTURE WHICH INCLUDES THE DEPARTMENTS OF RESEARCH AND SPECIALIST SERVICES, CONSERVATION AND EXTENSION SERVICES, VETERINARY SERVICES, AND TSETSE AND TRYPANOSOMIASIS CONTROL AND RECLAMATION, FOR THE YEAR ENDED 30TH SEPTEMBER, 1959.

J. R. CORRY, *Secretary for Agriculture.*

The unsettled conditions during 1958, especially in North America, and the slowing down of economic growth elsewhere over the last two years, turned out to be less harmful to world trade than had been feared, and the general consolidation which characterized the world economy in 1958 was followed by gradual expansion in 1959. Expansion in the more developed countries, which had partly resulted from the shift in terms of trade to their benefit, led to an unprecedented volume of raw materials entering world trade. This not only served to cushion the primary producing countries from lower prices but encouraged an expansion in the industrialized economies which has in turn led to a gradual rise in the price of raw materials. These developments combined with internal fiscal policy helped to keep the federal economy on an even keel during the year and greatly improved the country's balance of payments position. In this exports of agricultural produce have played an important part.

Two other international events have considerable significance for the future of our agriculture. The creation of the European Common Market and the counter-creation, on the instigation of the United Kingdom, of the European Free Trade Area are likely to have a considerable impact on the federal economy in the future and developments in both these fields have been carefully followed.

The Federation has been called on to report and explain the operations of its agricultural policy to the Contracting Parties to the General Agreement on Tariffs and Trade.

Although the season was not an easy one for farmers because of the late commencement of the rains and their early cessation in many areas, a record crop of tobacco more than compensated for a fall in price over the previous year. The maize crop, too, showed an increase over 1958 and in the livestock section beef exports were recommenced on a substantial scale. Pig supplies have continued to be satisfactory and the dairy industry has continued to expand. The abrupt termination of the rains, however, had an adverse effect on the grazing, which tended to decline in quality earlier than usual. Details of crop yields are given elsewhere in this report.

The maize costs survey was continued for the 1957-58 crop. A report on the results for the three years will be published shortly but this work has now been discontinued in the face of the need to examine other products. A new dairy costs survey is progressing well on the basis of 51 co-operating farms and analysis of data is now complete. The second year of the tobacco costs survey has also been completed and a new survey into cattle costs, involving 100 farms, has been initiated.

Following upon the establishment of the Ministry of Economic Affairs, responsibility for the Agricultural Marketing Council was transferred to that Ministry in May, 1959.

CROP PRODUCTION.

Federal Grain Marketing. During the year under review the Federal Grain Marketing Board has continued its programme of integrating the Southern Rhodesia and Northern Rhodesia marketing systems, and so disposing its stocks as to meet on a balanced basis the territorial needs.

The year was noteworthy in that for the first time Southern Rhodesia producers of maize were issued with bags free of charge, as noted later in this report

under Maize. It was intended that the Grain Marketing Board would handle this distribution for both territories but in the event distribution in Southern Rhodesia was left to the established trade and the Board handled only the Northern Rhodesia distribution, which it had undertaken for many years.

Maize Production—Southern Rhodesia. The acreage planted by Europeans in the 1957-58 season compared with 1956-57 showed a decrease from 371,062 acres to 349,270 or 5.9 per cent.

The 1957-58 European crop produced 3,589,600 bags or 10.3 bags per acre, a record yield per acre, but the total crop was 187,400 bags lower than the 1956-57 crop of 3,777,021 bags at 10.18 bags per acre. The 1957-58 crop was nevertheless the second highest total ever recorded, and ranks well when a poorer season had been foreshadowed from a late start to the rains. Farm retentions from the 1957-58 crops were high at 1,152,600 bags. The 1958-59 crop is expected to total 3,500,000 bags, of which about 2,500,000 were expected to come to the Grain Marketing Board, with farm retentions accounting for the difference.

The African-grown crop delivered to the Grain Marketing Board amounted to 512,000 bags from 1957-58 in comparison with 954,492 bags from the 1956-57 crop. The expected intake from the 1958-59 crop is 700,000 bags of which 546,000 had been delivered at 30th September, 1959.

Northern Rhodesia. The disastrous 1957-58 season in Northern Rhodesia reduced the European crop to 660,800 bags compared with the record 1956-57 season of 1,247,500. The acreage in 1957-58 was slightly lower at 118,060 compared with 123,550 in the earlier year. The 1958-59 season has been better, and the crop is estimated to be 968,000 bags in comparison with an original estimate of 1,289,000.

African deliveries from the 1957-58 crop suffered severely and fell to a mere 57,000 bags in marked contrast to the record level of 890,889 bags in the previous year. The 1958-59 crop is expected to result in deliveries of 540,000, of which 474,000 were on hand by the 30th September, 1959.

Exports. First reports of the 1958-59 crop indicated that there would again be a surplus for export, and in order to take advantage of a favourable market the Grain Marketing Board commenced shipments in February, 1959. 576,000 bags of old crop were exported against the 1958-59 surplus which, it now appears, will be 1,298,000 bags. Shipments of new crop have been made regularly since July, 1959. The Grain Marketing Board has altered the basis of sale of export maize for the new crop, and calls for tenders on an f.o.b. Beira basis instead of selling c.i.f. as formerly. The new system appears to have worked well and has been a great deal less trouble to the Board.

Prices. the 1957-58 crop was insufficient to meet local needs by some 325,000 bags, and as a result producers received the full price of 41s. 6d. per bag. For the 1958-59 crop the price of 38s. 0d. payable per bag for naked maize under the Maize Price Agreement and the anticipated net export realization of 21s. 0d. caused Government to prescribe an initial buying price of 33s. 6d. in Southern Rhodesia and 35s. 0d. in Northern Rhodesia. For the 1958-59 season Northern Rhodesian producers received an extra 2s. 6d. per bag on maize sold for Federal consumption in some compensation for the poor 1957-58 season. In the event realizations on the export market have been higher than expected and producers will be entitled to some additional payout.

Southern Rhodesia Seed Maize Association. During the 1957-58 season members produced and marketed their tenth hybrid maize crop. Nearly 32,500 bags of seed were produced, 4,000 more than the previous year. At Panmure, hybrid maize from a third crop of single hybrid seed was produced and was of exceptionally high quality.

Small Grains.—(a) *Kaffir Corn and Munga.* These two grains continued under federal grain marketing control throughout the year. The policy of determining producer prices for these grains not only in relation to the maize price but also taking into account the relevant supply and demand factors, continued for the 1958-59 crop.

Munga. As foreshadowed last year, there has been an increase in the offtake by local consumers and a fall in deliveries to the Board. The Board had in stock 44 400 bags at 30th September, 1959, in comparison with an expected stock of 92,000 and local sales of about 5,500 bags a month. It should therefore have sufficient stocks to see it through at the present levels of sales until the next crop

is on offer. The estimate of intake has been reduced from 150,000 bags to 46,000 bags, with actual intake to 30th September, 1959, at 35,870 bags, of which all but 240 was from Southern Rhodesian African growers.

The price paid by the Board was increased from 31s. 0d. to 33s. 6d. per bag for the 1958-59 crop in an attempt to increase deliveries to the Board, but as the figures show the amount coming forward is below estimates and local requirements.

Kaffir Corn. In regard to kaffir corn the position is somewhat similar, but here the Board is importing to make good the deficit. The 1959, crop was originally estimated to be 100,000 bags, for which the producer price was fixed at 37s. 6d. in relation to 34s. 6d. for the previous year. The crop estimate has now been reduced to 38,000 bags and the Board intends to import some 20,000 bags to meet the shortfall. These imports will consist of high quality kaffir corn for brewing purposes.

(b) *Rupoko.* The embarrassing stock position noted last year has shown some improvement and stocks on hand at 26th September, 1959, amounted to 210,458 bags compared with 291,414 bags at the same date in the previous year. In order to discourage deliveries the price was further reduced from 40s. 0d. to 33s. 6d. a bag, and the selling price reduced to 47s. 6d. from 50s. 0d. last year. The selling price is 40s. 0d. if the grain is used in stockfeeds.

Beans. Beans were decontrolled during the year and the Grain Marketing Board no longer handles this crop.

Groundnuts. It is disappointing to report that it was necessary to import even larger quantities of groundnuts than in 1958, to satisfy local requirements. This was due to the failure of the groundnut crop in Southern Rhodesia. Prior to 1958, no imports had been necessary for many years.

Total estimated marketed production of groundnuts in the Federation during 1959, was 260,000 bags, even lower than the previous year's total of 278,000, which compares very unfavourably with 441,000 in 1057 and 467,000 in 1956. As a result of the very poor crop it is estimated that some 111,000 bags will have to be imported and a further 50,000 bags purchased from Nyasaland. Since the imported price is considerably higher a price increase of some 17 per cent. to 101s. 0d. per bag to consumers became necessary and this in turn led to certain increases in prices of margarine, fats and oils.

The failure of the crop was restricted to Southern Rhodesia, where only 45,000 bags were marketed as compared with 91,000 in 1958, 213,000 in 1957 and a record crop of 290,000 in 1956. The failure can be attributed largely to the widespread incidence of "rosette". The Southern Rhodesia Government sought to increase production by providing seeds and advice as well as by increasing the pay-out to the producer but the crop fell even below the previous year's very low figure. Every effort is being made at present by means of seed distribution and further advice to ensure that production is once more increased.

Northern Rhodesia had a successful year with 64,000 bags in the Eastern Province, being a welcome increase over the 43,000 bags obtained in 1957, and efforts are also being made to develop production in the North Western Province. Marketed production in Nyasaland, estimated at 147,000 bags, has only been exceeded in 1957.

Due to the failure of the Southern Rhodesia crop the Federal Grain Marketing Board scheme for promoting production of confectionery nuts once more had a disappointing year. Producers of this grade of nut found themselves able to obtain £8 a bag when sold for seed, which price was far higher than its export value. In these circumstances the scheme for marketing confectionery nuts received little support.

Examination of groundnut material at the Seed Testing Laboratory revealed that very few Southern Rhodesian samples, whether European or African grown were up to the standard set by the Grain Marketing Board under their pilot scheme for the export of nuts of confectionery quality.

The material collected covered a wide range and reflected the very mixed nature of the native Rhodesian stocks. Efforts are being made to sort out this material and by selection and better cultural methods to produce a nut which will measure up to the exacting standards required by the confectionery trade overseas.

Potatoes. The quality of seed produced has improved markedly since the Rhodesian Seed Potato Association was formed and growers in the Eastern Districts are not able to fill the demand for seed produced there. Active steps

are being taken to produce a blight resistant white-fleshed potato, which the public demands.

The year under review has been in marked contrast to last year from the point of view of production.

The second irrigated crop of 1958 was a large one and was sufficient to meet Southern Rhodesia's needs until the main crop was lifted. The main crop in its turn proved nearly adequate because of the use on a wider scale of blight-resistant varieties and also an increase in acreage from 1,800 to 2,200 as a result of the acute shortage which had ruled throughout most of 1958. The first irrigated crop in 1959 consisted of white and of yellow-fleshed varieties. Here again the acreage was higher at 1,700 compared with 1,200 in 1958, but in addition to the increased acreage the early ending to the rains and the lack of weather conditions suitable for the development of blight also helped in producing a heavy crop. The result was a large supply of whites and yellows on offer concurrently. Plantings for the second irrigated crop in 1959 were also heavy.

There were also large increases in production in Northern Rhodesia. The quality of the rain crop was somewhat variable but the main problem was that the bulk of the crop was of the yellow-fleshed Pimpernel variety. This type of potato proved to be unpopular with consumers and disposal was difficult. Limited imports were necessary between crops in February and again during the first half of June. As in Southern Rhodesia, price control on potatoes was lifted on the 26th June, 1959 (see below). Producer prices were not affected until the end of September and consumer prices were 5d. to 5½d. per lb. in Lusaka and 6d. to 6½d. on the Copperbelt. By the end of September it became obvious that the winter crops were going to be large ones. Acreage did not appear to be greatly increased but higher yields had been obtained.

Following on a review during the year of potato marketing by the Agricultural Marketing Council, control of the producer and consumer price of potatoes was removed. This was followed by a rise in producer prices from 9s. 3d. to 10s. 6d. a pocket in Southern Rhodesia, consumer prices going up simultaneously; indications at the end of the year were that prices were likely to fall with the heavier second irrigated crop coming to market.

Other Crops. Again a negligible acreage of summer wheat was planted and this state of affairs seems likely to continue until the weed problem is overcome.

A great deal of interest was shown in kenaf and during the season some 1,500 acres were grown. In some instances yields of 2,000 lb. of fibre per acre were obtained. This yield can be considered very satisfactory. Unfortunately, owing to the closing down of the Umtali Jute Mills, growers have no longer a market for fibre and, unless an export industry can be developed, there would seem to be little future for this crop as a supplementary crop to maize.

Horticulture (Fruit and Vegetables). Climatically the season was quite favourable for most horticultural crops. Good progress was made in orchard management and fruit packing standards, whilst voluntary inspection of locally graded deciduous fruits was introduced.

A survey is in process on production and marketing of citrus as a result of heavy actual and planned plantings in the Sabi-Lundi lowveld, and the heavy increase in production to be expected when the trees "not yet in bearing" come into bearing. Much interest has been taken in grape growing both for fresh fruit consumption and wine production. Trial and commercial plantings have been made in many areas.

During the year, agreement was obtained from Government to a scheme which it is hoped will stimulate local production of vegetables. As from 1st January, 1960, the 1d. per lb. duty on imported vegetables will not be suspended for two years; towards the end of that period the industry will be examined to see whether it has responded to the stimulus and if it appears that there is some reasonable chance of it satisfying local needs, Government will consider whether to continue the duty in force.

Supplies of vegetables throughout the year appear to have been adequate although seasonal shortages necessitated importations early in 1959.

Climatically the season was favourable, a more even spread of rains with extra sunshine between storms doing much to reduce diseases of vegetables and crop losses.

Tobacco. The 1958-59 season was a record one for the Virginia flue-cured industry with total sales exceeding by nearly 20 million lb. the previous record

crop in 1956. Total sales were 191,295,878 lb., an increase of some 40 million lb. over the 1958 crop. The gross income of £27,451,230 was also a record, exceeding the year's gross revenue for the last three seasons which had remained at between £23 and £24 million, by at least £3 million.

Only in respect of average price per lb. can the year be regarded as less rewarding than previous years for with the average price of 34.44d. per lb. it was a drop of very nearly 2d. on 1958 and 5d. on 1957. The relatively low price was very largely compensated for by the yield per acre, which at 886 lb. was 84 lb. more than the previous record reached in 1957. This was a highly commendable achievement.

A total of 2,964 growers in the South-Western Area sold flue-cured tobacco, an increase of 143 over 1958 and 128 over the previous highest total which was in 1956.

A total of 216,000 acres of tobacco were grown as compared with 207,000 in 1958. The average acreage was 72.87 as compared with 73.38 in 1958. Over the last four years the average acreage grown by producers has shown very little variation.

The gross income per acre was £127 2s. 0d. compared with £111 19s. 0d. for 1958. The highest gross income per acre was that achieved in 1957, when it was £129 6s. 0d.

For the North-Eastern crop the year was a heartening one. Production increased—the first time for three years—to 1,682,000 lb. and yielded a gross income to the Province of £177,724, also the highest figure since 1957. The total acreage was 2,300, once again the highest figure for three years, and although the average price realized of 25.37d. must be regarded as disappointing, since the crop was regarded as the best yet sold, the average yield of 731 lb. exceeded the previous highest total in 1957 by just over 100 lb. This was a singular achievement. The quality of the crop improved very considerably. Unfortunately this was not reflected in the price received and meant a higher subsidy being paid by Government. The final subsidy figure was £30,780 as compared with £15,047 for the previous year.

A very small quantity of fire-cured tobacco was offered for sale in Salisbury from Southern Rhodesia. Only 22,520 lb. were sold for £808, an average price of 8.61d. per lb. An increase in fire-cured sales took place in the Southern Province of Nyasaland where 5,258,391 lb. were sold at an average price of 17.29d. In the Northern Province 17,616,608 lb. were sold at an average price of 10.94d. per lb.

Considerable interest continues to be shown in the production of Turkish tobacco and a growers' association, designed to foster the growth of Turkish tobacco, has now been formed.

It appears that the Turkish tobacco crop in the Rhodesias will be well over 1,000,000 lb. This is a welcome increase over the previous year.

The Burley tobacco crop in Southern Rhodesia was a poor one with only some 27,000 lb. being offered for sale. The first sale which took place in 1958, only yielded 32,000 lb. and no doubt the price of 16.47d. which was obtained acted as a disincentive to increased production this year. The average price for the 1959 crop is not yet known.

The United Kingdom continued to be the largest purchaser of tobacco, as the following declaration of purchases indicates.

SOUTHERN AND NORTH WESTERN RHODESIA

	lb.	%
United Kingdom	94,737,953	49·52
Australia	10,819,998	5·66
Local Market	6,225,002	3·25
Other Markets	79,495,610	41·56
Unallocated	17,315	0·01
	191,295,878	100·00

NORTH EASTERN RHODESIA

United Kingdom	1,096,692	65·23
Australia	6,292	0·37
Local Market	162,398	9·66
Other Markets	415,876	24·74
	1,681,258	100·00

Cattle, Sheep and Pigs. The cattle industry continues to expand at a satisfactory rate, and a record number of cattle again came on to the market during the year. Beef production in the Federation now exceeds the country's requirements by approximately 10 per cent. and greater efforts were necessary to provide markets for the additional beef. Investigations during the year into the prospects for exporting beef to the United Kingdom and continental markets indicated that the United Kingdom offered the best possibilities for surplus beef from the Federation. Federal beef exports have been well received on the United Kingdom markets and, with the necessary attention given to the selection of the desired quality, it would seem that a good market can be developed for chilled and frozen beef products from the Federation. Future prices will naturally depend on the total volume of imported supplies. The view has been expressed that financial returns will remain at a reasonable level for at least two years; during this period Rhodesian interests must become firmly established on the market by exporting regular supplies of consistently high quality beef.

A new cattle price agreement was concluded between the Federal Government and the Rhodesia National Farmers' Union which provided for more elasticity in price fixation. At the same time it maintained the desirable long-term price guarantee which has been so important in maintaining confidence in the industry. Following on the conclusion of the agreement a 2½ per cent. increase in cattle prices was granted. The guaranteed price refers only to beef produced for local consumption, and export profit or loss will be for the account of the producers.

The Cold Storage Commission showed a substantial increase in its turnover of cattle and considerable expansion in exports took place, but difficulties were experienced at times through lack of shipping space. Negotiations progressed satisfactorily during the year in connection with the extension of the Cold Storage Commission operations in Northern Rhodesia and the construction of the Commission's abbattoir in Nyasaland is nearing completion. Interest in sheep farming was maintained. Satisfactory negotiations between interested parties took place to establish a system of mutton and lamb grading in the Federation.

Pig production increased and sufficient pork products were normally provided to satisfy the requirements of the country. Small surpluses were available at times, but export possibilities were not very favourable because of the high cost of the local article in relation to prices on likely export markets.

Efforts to reduce the cost of pig production have been largely offset by the removal of the maize subsidy. This has made many producers realize the importance of relying on home produced feedstuffs, and to purchase only the minimum requirements to balance their rations.

The acquisition of modern processing facilities, for which plans are well in hand, will be of great advantage to the industry. A new Pig Industry Act was passed during the year and will assist to bring about greater integration of control in the affairs of pig production in the two Rhodesias.

Dairying. Dairy production continued to increase substantially and it is estimated that total milk production reached a figure of over 21 million gallons, which is an increase of about 14 per cent. on the previous year. This increase is reflected mainly in milk supplies to the two main marketing organizations through which the milk producer price agreement is operated, viz., the Dairy Marketing Board in Southern Rhodesia and the Co-operative Creameries of Northern Rhodesia. The number of suppliers to these organizations, as well as average production per supplier, continues to increase.

Consumption of milk and dairy produce does not show a corresponding increase to production and, in fact, butter consumption has fallen. Whole milk consumption, although increasing, shows a slower rate of increase than in recent years. Sales of skim milk, both sweet and sour, are increasing and there was an increase in sales of milk to Portuguese East Africa. The Dairy Marketing Board produced nearly one million pounds of skim milk powder in Gwelo and both the Dairy Marketing Board and the Co-operative Creameries of Northern Rhodesia produced sterlized milk.

Butter production reached over two million lb. while butter consumption fell, resulting in considerably less butter being imported than in previous years. The fall in butter consumption is attributable mainly to substitution by margarine containing 10 per cent. butter which was imported for most of the year. Towards the end of the year production of this type of margarine containing butter was being made in Salisbury using local butter.

A private factory for the production of Italian type cheeses was opened in Salisbury early in 1959 and this factory draws its milk supply from the Dairy Marketing Board.

Cheese prices remained unaltered while butter prices were reduced by 3d. per lb. in Southern Rhodesia ind 4d. per lb. in Northern Rhodesia to bring retail prices for butter in both territories to 3s. 8d. per lb. There were no changes in butterfat prices.

During the year a new milk producer prices agreement was negotiated and this came into effect in June, 1959. This new agreement is on the same general lines as the previous agreement. Owing to the higher proportion of milk surplus to whole milk requirements as compared to previous years the average actual price for milk fell below that of the previous year.

Monthly pay-outs in Southern Rhodesia were:

	Guaranteed Basic Price per Gallon	*Actual Pay-out to Producers Price per Gallon*
1958		
October	51.0d.	42.4d.
November	51.0d.	39.9d.
December	37.0d.	29.6d.
1959		
January	37.0d.	29.9d.
February	37.0d.	31.5d.
March	47.0d.	38.7d.
April	47.0d.	39.8d.
May	47.0d.	39.2d.
June	47.0d.	39.3d.
July	51.0d.	41.3d.
August	51.0d.	40.2d.
September	51.0d.	39.4d.

With the introduction of the scheme for the payment for milk on a quality basis in Northern Rhodesia at the beginning of 1959 milk prices in both territories were brought into line, although separate "milk pools" operated in each territory. The good dairying bonus formerly paid to producers in Northern Rhodesia was discontinued except in the case of supplies to the Zambezi Co-operative Dairies at Livingstone, where the milk price agreement does not apply.

Negotiations between the Farmers' Co-operative Industries in Salisbury and the Dairy Marketing Board resulted in the Dairy Marketing Board taking over the Salisbury Creamery on 1st July, 1959.

It is expected that the Dairy Marketing Board's new dairy at Salisbury will be in operation in 1960. The Nestle's Factory to be built in Salisbury to produce dried milk is expected to be in operation by the end of 1960.

It has been decided to introduce federal dairy legislation to replace present dairy legislation in Northern and Southern Rhodesia, and preparation of a new Federal Dairy Act has been put in hand.

Poultry. Apart from a short period at the end of July when poultry were in short supply, Southern Rhodesian producers were in a position to supply all local demands of poultry, apart from ducks and eggs. Egg prices were well maintained over most of the year reaching 6s. 3d. a dozen over the Christmas period and holding at around the 3s. 6d. a dozen mark until September when a drop took place.

During the year regulations were promulgated in respect of chilled eggs, these having to be stamped "chilled" if they had been stored at a temperature of 45°F. or below. The same regulations required the registration of all cold storage plants for egg storage.

Further expansion in the production of broilers is noticeable and quality of product has improved, particularly in presentation. New ventures in processing and distribution of frozen birds have been started in Southern Rhodesia which should result in better uniformity and control of stocks. The supply position in Northern Rhodesia is inadequate and imports from South Africa, though on a reduced scale, have been necessary. Government protection to local producers is afforded.

The local supplies of turkeys for the Christmas period were small and it was necessary to rely on imports to meet the shortfall. Imported supplies from the Union were difficult to obtain.

RESEARCH STATIONS.

Very useful work continues in progress at the various research stations.

At the Grasslands Research Station, Marandellas, which serves some 12½ million acres of sandy country in the high rainfall zones of north-eastern Southern Rhodesia, emphasis continues to be given to developing a system of ley farming for the maintenance and raising of soil productivity. With grasses for the ley system, work has been concerned mainly with attempts to establish principles of sound management. In assessing the productivity of pastures in terms of beef it has been found, once again, that the main effect of nitrogenous fertilizers is to increase carrying capacity, not gain per head. Attention has been given to developing a bacteriological laboratory for the study of legume bacteria and a more incisive attack on the problems involved in the provision of legumes for ley systems. Investigations have been initiated into the assessment of the properties of tile-drains in sandveld vleis.

The work at Henderson Research Station is showing the way through from the old time monoculture of crops and the traditionally separate livestock production methods into intensive and diversified crop, ley and livestock production. In all the investigations the overriding importance of nitrogen is making itself felt, and is being increasingly appreciated by the farming community as a whole.

On the crop and irrigation side the use of 40 lb. boron per acre has induced excellent growth of lucerne which has been extremely difficult to attain hitherto. Fertilizer and variety trials of many crops have continued. Continuous maize grown on the new high population/trash farming methods has maintained high yields on experimental plots, of the order of 24 bags per acre. "Continuous" maize has now been grown on the same plot for six years without any appreciable loss of heart in the soil.

Work has extended on vegetable seed production since a late start in the middle of the rainy season. It is hoped also that future work will include a determined investigation of the causes underlying the high costs of milk production.

At the Matopos Research Station, previous indications of responses to higher plant populations in maize and sorghums, legumes for hay and silage crops under dry-land conditions were repeated despite another short season. Similarly responses were again obtained to nitrogen and phosphorus applications to maize on the granite sands but not on heavier soil. Trials have continued on castor beans, groundnuts, early planting of irrigated potatoes and hybrid maize and sorghums.

Since livestock production in Matabeleland is dominated by a pronounced deficiency of protein in the winter grazing, intensive studies are in progress on the Station to determine to what extent the production of beef in this area can be increased through the feeding of locally produced protein-rich fodder crops.

These studies have now been in operation for three years and from the limited information collected it seems clear that provided sufficient feed can be produced the success of such a farming system will depend largely upon whether the rate of maturity of the normal run of cattle in this area can be increased through selective breeding.

At the same time critical studies are being made of the differences in reaction of improved and unimproved breeds to changing environmental conditions. These results are of primary importance in developing suitable systems of management for the various breeds found in this area.

The rearing of sheep for the production of mutton is becoming increasingly popular and the sheep production studies on this Station have been intensified to develop suitable systems of management for the production of mutton in this area.

The results of the valuable work being done in connection with veld management are set out in the report by the Officer in Charge.

At the Sabi Experiment Station fundamental work on water requirements and the effects of water and crops on soil conditions continued.

Good climatic conditions allowed for very satisfactory cotton crops, commercial yields being of the order of 3,000 lb. seed cotton per acre. Marked response to nitrogen and to kraal manure was obtained. A depth of cultivation trial indicated that deep ploughing may be beneficial especially where subsoil aeration is a limiting factor. Particular attention has been given to the distribution and alternate host plants of the pink bollworm which was recorded on cotton this season for the first time.

Satisfactory maize yields were obtained, although not as good as those obtained last season.

All susceptible wheat varieties suffered heavy stem rust damage which was associated with abnormally "wet" winter months. A farm scale planting of a resistant selection, however yielded 10.7 bags and showed negligible rust damage. As with maize, substantial nitrogen was found to be required for wheat following continuous grain. Over 60 varieties and selections of wheat were planted for further selection and seed increase.

Water losses from the Development Farm canals and from the night storage dam have been investigated. Water table investigations show that no water has been recorded to a depth of 40 feet except in two cases bordering canals.

At the Gatooma Research Station, Albar 637 has maintained its promise, this variety showing improvements in yield, ginning outturn, bacterial blight resistance and lint quality. Seed has been issued to selected growers for bulking up in the hope that this strain will be available for general planting for the 1960-61 season.

Detailed biological investigations on the egg, larval and pupal stages of the red bollworm in the field have high-lighted the importance of certain ants as being responsible for an appreciable measure of control.

Preliminary investigations were started on the effect of certain herbicides applied for weed control in cotton and also on cotton harvesting methods.

During the ten-year period since hybrid seed maize was first made available to Rhodesian farmers, 11 hybrids have been marketed from the Salisbury Agricultural Experiment Station. These hybrids are all the result of crossing seven of the station's earliest inbreds in different combinations and all mature approximately two weeks earlier than the most popular of the white open-pollinated varieties, Hickory King and Southern Cross. A twelfth hybrid has been added for the 1959-60 season and this may be considered the first of a new range of varieties.

Good progress has been made in wheat breeding since the appointment of the wheat breeder in 1955. Included in the 1959 winter yield trials were, for the first time, wheats developed from crosses made by the Wheat Breeder since his arrival. One of these, from a cross between Federation and an Angola variety, yielded at the rate of 24 bags to the acre and outyielded the standard variety, Punjab, by more than ten bags an acre. This result is most encouraging.

In view of the difficulty in finding a suitable blight resistant substitute for the Up-to-Date variety of potato it is intended as a long-term solution to start a limited breeding programme and the Plant Breeding Institute, Cambridge, are making available some of their most promising seedling material for testing in Salisbury.

In the past, stocks of healthy potato seed have been available only by regular importations from overseas countries, most usually Scotland. It is hoped that in the future, by maintaining stocks in the higher and cooler eastern parts of the country, these importations will not be necessary or have to be made so frequently.

GWEBI AGRICULTURAL COLLEGE

Gwebi Agricultural College reports that the standard of work was again of a high level, the results including 12 First Class Diplomas, carrying 17 Distinctions, and 17 standard Diplomas, carrying one Distinction. Since the introduction of First Class Diplomas in 1957, 38 per cent. of those sitting the Final Second Year Examinations have qualified as First Class students.

Despite the fact that a 50 per cent. expansion of the College took place in 1954, the number of suitably qualified applicants for entry has tended, once more, to exceed the capacity of the College.

The maize yield was a College record averaging 21.7 bags per acre over 244 acres; whilst the livestock herds once again maintained a high level of production.

Useful information has again been forthcoming from maize and potato experiments, and from the pasture work.

CHEMISTRY

The Chief Chemist reports that with the staff position greatly improved, good progress has been made during the past year. The total number of samples analysed amounted to 9,169 as compared with 7,130 for the preceding year. The individual sections contributed to this number, as follows:

General Section	2,337
Soil Testing Section	5,666
Research Section	1,166
	9,169

The number of samples analysed by the General Section showed an increase of 23 per cent. over that of the previous year. More than half of these samples were analysed for various government deparments, including 662 toxicological specimens for the Veterinary Department and several hundred samples of plant materials, blood and bones for research stations. Seventy-nine samples of fertilizers, farm feeds and cattle dips were examined under the provisions of the Fertilizers, Farm Feeds, Seeds and Remedies Act, 1952. There is an increased interest in agricultural liming materials, as judged from the number of limes and limestones received (55). The collection of samples of radio-active fallout for the United States Atomic Energy Commission has been continued.

The output of the Soil Testing Section, in terms of samples analysed and reported upon, showed an increase of 67 per cent. over the figure for the previous year.

A considerable amount of useful investigatory work was carried out by the Research Section. A large number (1,166) of samples of herbage, faeces, and other materials were analysed for various research stations in connection with their pasture and animal nutrition research. Good progress was made in the spectrographic laboratory with investigations on the minor element status of Rhodesian soils, heavy metal toxicities, mineral deficiencies in crops, and related problems. Other research work was concerned with investigations on the organic matter breakdown and moisture retention in Rhodesian soils, the effectiveness of ammoniated superphosphate, soil acidity, and slatiness and nutrient uptake of tobacco. Several scientific and popular papers have been published during the past year and others are awaiting publication.

The Soil Survey Section completed the field work for the survey of the Southern Rhodesia area of the Zambezi Valley below Kariba, and the report should be available in the near future. In addition, a soil survey of various farms comprising the Matopos Research Station as well as a number of minor surveys and investigations were carried out.

ENTOMOLOGY

In the Entomology Branch there were several staff changes and transfers during the year. The senior Entomologist resigned to take an appointment with the Scottish Horticultural Research Institute and another officer who had been on loan to the Grain Marketing Board and responsible for pest control investigation there had to be recalled on promotion to the vacancy. Research into grain pest control problems was strengthened by the secondment of a man from the Pest Infestation Laboratory, Slough, England, to the Grain Marketing Board for a two year period for special study of fumigation problems. Satisfactory progress has been made and this is reflected by considerable reduction in grain losses during storage and an improvement in the quality of grain for export.

Other principal problems being studied are fruit fly, fruit piercing moth and wooly aphis.

An outbreak of pink bollworm was discovered infesting cotton grown under irrigation in the Sabi Valley. This is a serious pest of cotton in many parts of the world which has not been found in Southern Rhodesia previously. Phytosanitary measures were introduced to limit its spread. The biology and behaviour of pink bollworm in the Sabi Valley is being studied in co-operation with the Cotton Pest Research Scheme with a view to its control.

BOTANY AND PLANT PATHOLOGY

Interest in the potentialities of seed crop production continued to grow and the volume of samples and inquiries was such that they strained the resources of the Seed Testing Laboratory and its staff to the utmost. The number of visitors to the Laboratory during the year rose to more than 400. Production again expanded in all branches of this new industry, certified grass seed increasing from 80,000 lb. in 1957-58 to 108,000 lb., certified seed potatoes from 37,000 to more than 41,000 pockets (75 lb.), whilst the acreage under vegetable seed

crops rose from 476 to no less than 1,378 acres. Vegetable seed production during the period under review is likely to be around 750,000 lb. the bulk being pea seed. Despite a late start and various teething troubles the new Tobacco Seed Association had a successful inaugural season producing 1,652 lb. of certified seed. Remarkable progress is again reported from the Herbarium whose collection almost reached the 100,000 mark representing an increase of nearly 12 per cent. The number of new accessions was an all-time record, the Northern Territories again supplying a substantial proportion of the specimens received. Unavoidable printing difficulties delayed the appearance of the first volume of the Flora Zambesiaca, work on which continues to proceed satisfactorily. Increased attention was paid to local weed problems and to poisonous plants.

In general the summer crop season did not favour the onset of diseases, late blight, for example, being less troublesome to potatoes and tomatoes than for many years past. Early rains led to unseasonal outbreaks of angular spot and anthracnose in tobacco seed-beds but the crop in the field was relatively free from serious diseases.

Two exceptions to the overall pattern were the prevalence of mildew on peas which was associated with exceptionally high temperatures during the period April to June, 1959, and widespread outbreaks of stalk-rotting in maize.

A disturbing increase has also been observed in the occurrence of maize streak virus which has tended to increase its geographical range to the principal maize growing districts of the highveld.

Research was continued on disease problems of maize, wheat, potatoes, legumes and fruit. Investigations on seed-borne diseases were hampered by the more immediate practical demands of the seed industry, nevertheless useful progress was made with several long-term studies on maize, tobacco and groundnuts.

Much needed extensions to the Botany Herbarium and to the Seed Testing Laboratory were commenced during the closing weeks of the period under review.

CONSERVATION AND EXTENSION

Officers of the Department of Conservation and Extension continued to advise farmers on various aspects of crop and animal husbandry through the medium of farm visits, farmers' days, discussion groups and the publication of a great range of popular and scientific articles. This effort was to good avail.

Very satisfactory progress was made in the spheres of soil and water conservation, a most encouraging feature being the striking increase in the number of dams that were built in Matabeleland during the year.

Erosion control research work at Henderson Research Station proceeded according to plan despite certain staff difficulties.

Production from winter irrigation increased substantially during the year but that from summer supplementary irrigation declined. Irrigation Officers employed by the Department have continued to work in close co-operation with farmers whose efficiency in the field or irrigation is steadily improving.

No less than 152 field trials and demonstrations were carried out in Southern and Northern Rhodesia during the year, many serving as items of discussion at field gatherings. A small number of these trials were established on behalf of the Department of Research and Specialist Services and the Tobacco Research Board of Rhodesia and Nyasaland and a fair number were done at the request of certain I.C.A. Committees.

Considerable progress was made in land use planning in both Southern Rhodesia (on a farm basis) and Northern Rhodesia (on a farm and regional basis), the increase in output reflecting the developing skill of the field officers concerned and the rapidly growing enthusiasm of the farmers for this service.

The adoption of one-day conservation field visits for teachers in place of proper courses of longer duration was made necessary because of financial and other reasons. These outings have proved popular among teachers who appreciate the informal atmosphere and the opportunity of learning at first hand, in the field, about various aspects of conservation.

A great deal of attention was paid to in-service training during the year, the major emphasis being on farm planning courses in which all the officers of the Department have now participated. The standard of training has been maintained at a high level.

The Young Farmers' Club Movement has continued to grow and the number of clubs has now reached 75 in the two Rhodesias.

As in the past, good progress has been made at the six experimental farms run by the Department, all of them serving a useful function in solving local

problems and demonstrating sound methods and systems of farming in their respective areas.

I.C.A. and Group Committees did much good work during the year, the cordial relationship between them, the Natural Resources Board of the two Rhodesias and the officers of the Department being maintained and strengthened.

VETERINARY SERVICES

The year opened with foot and mouth disease present in Wankie Native District. This outbreak commenced in August, 1958, and by the 18th September, 9,885 head of cattle were inoculated with virus. Satisfactory cordoning of the infected area ensured that no further spread resulted. On the 30th January, 1959, an outbreak was confirmed in Beitbridge Native District within the junction of the Bubye and Limpopo Rivers. By the end of February 5,755 head of cattle were inoculated with virus and no further spread occurred. A third outbreak occurred on an isolated farm in Wankie Native District during February. Only 191 head of cattle were involved and it was possible to herd these cattle closely with Veterinary Cattle Guards until they were slaughtered at Wankie Abattoir, for local consumption.

The factor common to all three outbreaks was the high game population with resultant cattle-game contact. The erection of a game fence has commenced adjacent to the Wankie Game Reserve in order to prevent the migration of game into the adjacent cattle areas.

Trypanosomiasis incidence has changed little from last year. Increased use is being made of the various types of curative and prophylactic drugs and it has been possible to maintain cattle in areas inhabited by tsetse fly with a minimum of loss. To enable the efficacy of various drugs to be gauged, a small field experimental station is operating at Kariangwe in Binga Native District.

The incidence of rabies continues to decline. Only 28 cases were confirmed during the year and the majority occurred in districts bordering other countries.

Outbreaks of other scheduled diseases had been kept at a very low level, notably those which are tick-borne. The new organic acaricides are gaining in popularity and are proving most useful provided they are used correctly.

Contagious epididymitis and Vaginitis ("epi-vag") continues to decline in incidence. Only 32 properties remained in quarantine at the end of the year. Contagious abortion remains fairly prevalent as many stock owners still do not vaccinate their young cattle. Vibriosis has now been confirmed on 55 properties but, as yet, it cannot be said with any certainty that infection is on the increase, as diagnostic methods have recently greatly improved.

Less progress has been made in the Tuberculosis Eradication Scheme than in previous years. An additional 2,644 head of cattle were tested during the year and the total dairy cattle under test is now 37,981.

Internal parasites of cattle and sheep continue to receive special attention and much publicity has been given to this problem. Farmers are becoming conscious of the ravages which can be caused to livestock by infestations with helminths. During the past two years, one professional officer has been engaged exclusively on parasitological investigations.

The Artificial Insemination Service has made steady but unspectacular progress. Increased use resulted at Bulawayo sub-centre following the introduction in February of a scheme whereby farmers pay a flat rate of 25s. 0d. per insemination inclusive of mileage. This has encouraged the farmer on the perimeter of the area served to make greater use of this service.

TSETSE AND TRYPANOSOMIASIS CONTROL AND RECLAMATION

Again the threat of tsetse advance into the south-eastern lowveld has provided the major anxiety. A combined operation using insecticides followed by mechanical bush clearing is giving encouraging results. These methods have now replaced game destruction as the basis of tsetse defence west of the Sabi River.

In the Zambezi area the situation has remained stable and good progress has been made in consolidating the defence line, especially in the Sebungwe. While the general policy of the Department is to replace game slaughter by other methods, when shooting is still used every effort is made to intensify it as much as possible in order to bring it to an end the sooner. The use of shotguns against smaller game has been developed for this purpose.

A welcome indication of progress has been the reintroduction of cattle, on a trial basis, to the Urungwe Native Reserve.

In Chipinga attempts are being made to develop new methods of bush control and to investigate the use of insecticides to augment the effect of the barrier clearing.

DEPARTMENT OF RESEARCH AND SPECIALIST SERVICES

ANNUAL REPORT FOR THE YEAR ENDED 30th SEPTEMBER, 1959

DR. B. S. ELLIS, *Director of Research and Specialist Services*

STAFF

From the point of view of organization the most important event of the year was the consolidation of the post of Chief Agriculturist into that of Deputy Director, a post to which Mr. T. K. Sansom was appointed on the 1st July. The creation of this post has greatly relieved the Director of what was becoming a very heavy burden of administration, and it will enable him, and the Deputy Director, to give more time to visiting Stations and Laboratories and to co-ordinating and encouraging research.

There was the usual small number of resignations from the Department during the year, but posts were readily filled and the dislocation, apart from that caused in the case of the Plant Breeder at Matopos, has been negligible. The only important post which remains unfilled is that of Chief Horticulturist.

The general situation is indicated in the following table:

Establishment:	
Superscale Posts	13
Senior Professional Officers	34
Professional Officers	58
Technical Officers	95
Clerical Officers	31
African Posts	71
Contract Posts	2
Total	304
Resignations:	
Technical Assistants	7
Professional Officers	2
Total	9
N.B. These include 2 terminations of secondments.	
Transfers:	
Professional Officers	nil
Technical Assistants	3 from Dept. 2 to Dept.
Total	5
Officers Appointed:	
Professional Officers	8
Technical Assistants	11
Total	19
Vacant Posts:	
Superscale	1
Professional Officers	6
Technical Assistant	1
Total	8

DEPARTMENTAL CONFERENCE

The Conference of this Department, which previously was an annual occurrence but which last year lapsed, was renewed again in the year under review. It was opened by the Minister in the magnificent main lecture hall of the University and was devoted to the subject of "Legumes in Federal Agriculture". In addition to our Colleagues from Northern Rhodesia and Nyasaland, whose considerable contribution to our discussions we have come to anticipate with pleasure, we were able this year to welcome the then Deputy Director of Agriculture of Bechuanaland; he has since become Director.

By general consent the Conference was of considerable value and the general level of the papers presented of a high order.

COTTON INSECT PESTS

The hoped for expansion and extension in this co-operative research effort, which were referred to last year, were approved and a further entomologist will soon be stationed at Gatooma. As is now fairly generally known, the scheme, which in many ways is unique, is financed jointly by the Federal and Nyasaland Governments and by the Colonial Development and Welfare Fund. The actual work is developing very promisingly.

RESEARCH

The outstanding development of the year, in fact of very many years, was the formation of the eagerly awaited Agricultural Research Council, although no meeting was held until shortly after the expiry of the year under report. The Council as constituted included some of the leading agricultural figures of the Federation together with business men and public figures of considerable standing and with Sir Ronald Prain as Chairman. The acceptance of the Chairmanship by Sir Ronald Prain, and of membership by his colleagues, gave pleasure to all concerned and ensures the necessary and essential standing and authority of the Council.

Within the sphere of departmental research the year was notable for the first policy meeting attended by all heads of Branches, Stations and other interested departments. Each Station and Branch had prepared a full report of its achievements to date, of the place of their findings in federal agriculture and of the main gaps and deficiencies in knowledge which still hindered agricultural development and progress. These really important studies had all been carried out with the greatest care and thoroughness, and, in spite of prior circulation, provided so formidable a mass of information that it was impossible to analyse it all at a single meeting. Nevertheless some factors of outstanding importance were discussed in detail and as one result there will be, within the general picture of departmental research, a greater emphasis than in the past on climate and crop ecology. The collected papers will be made available, if required, to the Agricultural Research Council. The Annual Conference, which followed hard on the heels of the policy meeting, supplemented and reinforced the discussions there in a manner which had not been foreseen.

Following the policy meeting, the planning meetings of the Departmental Research Advisory Committee at each Research Station later in the year were more than usually valuable. The problems were defined, the policy had crystallized and each Station had a sense of confidence and purpose.

Federal Research. Under the chairmanship of the Director of Research and Specialist Services, the Federal Research Advisory Committee met several times during the year to discuss specific research problems common to all Territories and to draw up a list, for eventual presentation to the Agricultural Research Council, of the main fundamental problems of agriculture in Central Africa.

It is believed that the work of this important committee, which ensures a common appreciation of research problems by the different Territories as well as effective co-operation in carrying out any agreed programme of work, will become increasingly valuable. In the coming year very important discussions on systems of land use throughout the Federation will take place.

FEDERAL STANDING COMMITTEE ON AGRICULTURAL PRODUCTION

With the cessation of Mr. Staples' term of duty for the purpose, the chairmanship of the Federal Standing Committee on Agricultural Production reverted to the Director of Research and Specialist Services. Since that date one meeting has been held in Northern Rhodesia following a very successful and stimulating tour of the Mazabuka area. It was during this tour that the importance of devising proper farming systems for different classes of land, which had become increasingly apparent, was seen to merit a federal approach.

FERTILIZERS

During the year the Fertilizer Advisory Committee was expanded to include the Directors of Northern Rhodesia and Nyasaland so that more consideration than had previously been possible could be given to any specific fertilizer requirement of either Territory. A special meeting was held during the year at the request of the Tobacco Research Board, to discuss the question of off-type tobaccos and to devise chlorine-free mixtures for certain tobacco soils.

STUDY TOURS OVERSEAS

The great generosity of the United States International Co-operation Administration and the Food and Agricultural Organization of the United Nations, to which tribute has been paid before, enabled more of our senior officers to do research and visit research institutions in Britain, America and other parts of the world, and, on their return, to plan their research programmes with increased confidence and authority. The wide dissemination of assured expertise, following on the return of what is now a large number of specialist officers, must be having a profound effect on the general level of both discussion and endeavour in the Department.

COMMITTEES AND BOARDS

The Director, or his Deputy, served on the following Committees and Boards:

Federal Standing Committee on Agricultural Production (Chairman).

Federal Research Advisory Committee (Chairman).

Departmental Research Advisory Committee (Chairman).

Fertilizer Advisory Committee (Chairman).

Tobacco Research Board.

Cabinet Sabi Valley Development Co-ordinating Committee.

Tsetse and Trypanosomiasis Committee.

Chibero Agricultural College (Sub-committee) (Chairman).

Senior Officers of the Department served on numerous inter-departmental committees.

VISITS OUTSIDE THE FEDERATION

The following officers attended various meetings and conferences or participated in study tours:

Dr. B. S. Ellis attended a meeting of the International Red Locust Control Council in Lourenço Marques.

Dr. B. S. Ellis attended a Specialist Pedological Conference in Pretoria.

Mr. T. K. Sansom visited Portuguese East Africa in connection with kenaf mechanization.

Mr. T. K. Sansom visited Pretoria to discuss export possibilities of kenaf.

Mr. G. Townsend paid two visits to Beira on tobacco inspection duties.

Mr. J. A. Whellan attended a meeting of the Phyto-Sanitary Commission in London.

Mr. J. A. Whellan visited the United States on a study tour under the auspices of I.C.A., and returning via the United Kingdom attended an International Locust Control Meeting.

Dr. A. Maar visited Greece, Israel, Jugoslavia and Italy to attend a Natural Resources Symposium and to study fisheries in other countries.

Dr. D. H. Saunder and *Mr. H. L. Corby* attended a meeting on grain legumes, in Bukavu, Belgian Congo.

Dr. G. R. Bates attended an F.A.O. Technical Conference and an executive meeting of C.S.A. in Liberia.

Dr O. West attended a conference and visited pasture research stations in Kenya.

Mr. R. G. Jones visited the Dairy Section of the Rand Show.

Mr. J. C. Raath went to Pretoria to attend a meeting of the Litter Testing Control Committee.

Mr. J. C. Raath went to the United Kingdom and the Continent to investigate technical questions concerning the beef market.

Mr. R. G. Thomas and *Mr. J. G. Thompson* attended a Specialist Pedological Conference in Pretoria.

Dr. J. O. Whiteside went to the Union to meet American experts there and to study cirtrus and vegetable diseases.

Dr. G. R. Bates visited agricultural research laboratories and establishments in Kenya while attending a C.S.A. Meeting.

Mr. P. E. L. Thomas paid a visit to the Union to study seed and vegetable production under irrigation.

Mr. R. G. Jones attended the International Dairy Conference in London and while there interviewed applicants for vacant posts.

Mr. I. M. van der Lingen went to Denmark to participate in an F.A.O. Training Centre on Fisheries Surveys.

Mr. D. L. Barnes visited the United States to study pasture research and management under the auspices of I.C.A.

Mr. V. J. Montague visited the Union and later, while on leave, visited stations in Britain and the Continent to study potato breeding.

ACKNOWLEDGEMENTS

I would like to express my appreciation of the efforts of all members of the Staff for their loyalty, enthusiasm and hard work, often in the face of disappointment.

I would like as before to mention the close and friendly co-operation between this Department and the Department of Conservation and Extension in particular and the efforts continuously made to ensure the most harmonious working of research and extension services. Co-operation with other departments and indeed with other Ministries and even Governments, is equally close and friendly even though, of necessity, it is more discontinuous. The Department continues to face the future with confidence.

CROP PRODUCTION

T. K. SANSOM,

Assistant Director, Department of Research and Specialist Services

Seasonal Conditions. On the whole, rainfall totals have been lower this season than for some years previously. The season appeared to be making a good start when September and October thunderstorms produced more rain than usual, but November was in most places hot and dusty, as November, 1957, had been. This season, however, the hot and dry weather did not continue into December as it did in 1957. The main feature of this season from December onwards was the series of breaks affecting most of the country, but the South in particular. In December cyclone "Aphrodite" caused a break. In January a bad break of 10 to 14 days affected almost the whole country, and in February rains were generally poor over the west of the country. The main rains ended at the beginning of March and the showers of the past rainy season were conspicuously below normal in both incidence and amount.

Noteworthy heavy falls have on the whole been lacking. Some falls of up to seven inches in 24 hours were recorded in the Mazoe Valley in January and February, but apart from these, falls of four inches and over were more or less confined to the Eastern Border District.

THE MAIZE CROP

Estimate of Yields. The final forecast of the European grown maize crop in Southern Rhodesia is approximately 3.5 million bags from 340,000 acres. This represents an average yield of just on 10.3 bags an acre, which is very slightly lower than the previous highest yield obtained in the 1957-58 season. Although the average yield per acre is just about the same as in the previous season the acreage planted and the estimated yield are less than the previous two seasons. In fact the acreage under maize in 1958-59 is the lowest of any season during the past ten years, as the following table shows.

Season	Number of Growers	Area Planted	Crop Reaped	Yield per acre
1950/51	3,916	343,521	1,176,528	3·42
1951/52	4,095	361,024	2,454,047	6·80
1952/53	4,176	363,204	2,360,011	6·50
1953/54	4,154	359,709	2,687,314	7·50
1954/55	4,170	364,059	2,734,920	7·51
1955/56	4,087	342,509	3,434,797	9·74
1956/57	4,162	371,062	3,777,021	10·2
1957/58	3,997	349,270	3,589,600	10·3
1958/59 (estimated)	4,000	340,000	3,500,000	10·3

The season was again not a favourable one, as the main rains again ended early in March with the result that the grain did not fill out as well as it should have. The high yields obtained were due in great measure to the much higher standard of farming practised and the increasing use of nitrogen over the past few years.

SOUTHERN RHODESIA SEED MAIZE ASSOCIATION

Final Report for the 1957-58 Season. During this season members produced and marketed their tenth hybrid maize crop. Fifty-four members delivered and sold nearly 32,500 bags of 200 lb. each. This was grown on 3,675 acres, so that the average yield was nearly nine bags an acre. The quantity sold was about 4,000 bags more than in the previous year and 8,000 bags more than were sold three years ago. Approximately 7,000 bags were sold to Northern Rhodesia as compared with 5,000 in the previous year and small consignments were sent to the Congo, Portuguese East Africa and Nyasaland. Fifteen members, growing solely for their own use, planted 110 acres.

For the third year in succession it was necessary to call in the 20 per cent. reserve which, according to the rules of the Association, has to be held for use during the following year if circumstances are such that the current year's crop fails to meet requirements.

Four hybrid strains were grown, name numbers 1, 8, 10 and 11. The two latter were marketed for the first time as they are derived from the inbred known as N 3-2-3-3. It is replacing inbred N 3-1-4-9 as it has proved to be more resistant to attack by *Helminthosporium turcicum*.

Interim Report for the 1958-59 Season. In the 1958-59 season, 3,718 acres were planted by members for hybrid seed production. In addition 140 acres were sown by 21 members for their own use only. The new single hybrid formed by combining inbred N 3-2-3-3 with A 5-7-6 was issued to all members this season for use on the female parent. Not only is it more resistant to *H. turcicum* but it has a larger proportion of 10-row ears which produce wide kernels and which are thought to be more suitable for the export market than the narrower kernels of the old type of hybrid.

While the new single hybrid has had an influence on the width of the kernel a new male also has been introduced whose stalk growth is much more robust than that of the old hybrids. Its yield of grain is greater, the kernels are wider and it is more resistant to *H. turcicum* than any of the parent stocks used hitherto. The limited amount of seed available was given to three members who used it to cross with the N 3-2-3-3 X A 5-7-6 female to make double cross seed which has been designated Hybrid No. 12. It is being distributed in small amounts to a large number of commercial growers in order that it may be tried out over a wide area under as many different conditions as possible. If it proves to be much better, as appearances in the breeding patches have indicated this year, the demand for the old types of hybrid is likely to decline rapidly.

Germination Tests. This year, for the first time, the Seed Analyst has made separate germination tests of the large and medium flats instead of testing a single sample by combining the two grades. As a general rule the two grades of the same crop have given a similar percentage of viable seed. However, there have been wide differences between samples of different growers. The reason for this wide variation is not known, but it is suggested that reaping and putting into large dumps before the ears were sufficiently dry may have been at least a contributory cause of the trouble.

Seed Maize Prices. There has been no change in the prices for seed maize during the past season which remain as follows:—

Certified double hybrid seed:—

Large Flats and Medium Flats	...	£5.10.0 per bag of 200 lb.
Large Rounds	...	£3.10.0 per bag of 200 lb.
Small Rounds	...	£3. 5.0 per bag of 200 lb.
Certified Open-pollinated Seed	...	£4. 0.0 per bag of 200 lb.
Uncertified Open-pollinated Seed	...	£3. 0.0 per bag of 200 lb.

It has been recommended, however, that control should be removed over the prices of open-pollinated seed. Up to the present only certified double hybrid medium flat seed is sold by the Southern Rhodesia Seed Maize Association, but during the present season large rounds have been sold, firstly to ensure that as much seed as possible of the new hybrid No. 12 should be distributed, and secondly large rounds are equally as good for seed purposes as large or medium flats. In the past the objection to large rounds was the fact that planting plates were not suited to them but with the new types of planters, this difficulty has been completely overcome.

Hybrid Maize Farm. The third crop of single hybrid seed has now been produced on Panmure Hybrid Maize Farm. Unfortunately, owing to a prolonged rainy spell when it was impossible to clean the lands even by hand, and also to the fact that the rains ended very early in the season, the amount of seed produced was less than expected, in spite of the fact that an adequate acreage had been planted. Owing to the excessive demand for seed for planting in the 1958-59 season and coupled with the lower yield mentioned above, it has not been possible to carry forward a season's reserve, but strenuous efforts are being made to rectify the position during the coming season by planting a still larger acreage on Panmure and by having seed produced by growers convenient to Salisbury. Again the seed produced is of exceptionally high quality and many complimentary comments have been passed on it.

Small acreages of wheat have been planted for the Wheat Breeder in order to bulk up supplies for distribution to farmers.

Fire-cured and Burley tobacco experiments, limited to a maximum of five acres a year, have been conducted since this farm was taken over by this Ministry

from the Shamva Fire-Cured Tobacco Committee. These experiments are under the control of the Chief Tobacco Extension Officer.

Sugar-cane Trials. Small plots of four varieties of sugar-cane have been planted to ascertain whether the Mazoe Valley is suitable for the production of sugar-cane. There is a very considerable irrigation potential in this area and the soils are of high inherent fertility and should therefore be very suitable, but it may be that frosts will be the limiting factor in the successful production of sugar-cane, and it is for this reason that the trial plots have been established.

Summer Wheat. Again the acreage grown and the quantity of summer wheat produced was negligible. Small plantings were done by farmers, and although fairly satisfactory wheats for summer conditions have been produced, the weed problem has by no means been overcome, as weeds which do most damage to the wheat crop are of the grass family and to kill them with herbicides would also mean killing the wheat crop. Until this problem has been overcome it is unlikely that there will be any material increase in summer wheat production.

As in the past, trial plots embracing fertilizer and spraying trials for weed control continue to be done on the various Government Research Stations.

Winter Wheat. The 1958 winter wheat crop amounted to 10,500 bags grown on 2,130 acres which gives an average yield of only 4.9 bags an acre. The total crop amounted to 1,599 bags less than in the 1957 season and 4,941 bags less than in the 1956 season. Over 20 years ago, in a good season, winter wheat production amounted to six times as much and never less than four times as much as present production. The story of wheat growing is a sorry one of decreasing acreages, while at the same time the Federation's consumption continues to increase rapidly. There is no doubt whatever that this country could easily grow ten times as much wheat as is now grown under present irrigation schemes and on moisture-retaining soils, as varieties are available which are very highly resistant to the incidence of rust attack and winter conditions are eminently suited to the production of high yielding wheats of excellent quality.

Sorghum Production. Sorghum growing continues to attract little attention from farmers. It is most unlikely that this crop will make any headway in the drier areas of the Colony so long as the succession of good seasons continues. In the meantime the Matopos Research Station has done a great deal of work on varieties best suited for particular localities, spacing, fertilizer and date of planting trials, etc., so that if farmers do wish to grow sorghums, the information will be readily available.

Rhodesia Seed Potato Association. There has been a great improvement in the quality of the seed marketed since the amalgamation two years ago of the Eastern Growers' Association and the Salisbury Area Potato Growers' Association. There has also been a much closer liaison between producers of seed in the Eastern Districts and growers of ware potatoes throughout the country. The demand for seed produced in the Eastern Districts exceeds supply. For the first time this season seed has been marketed in attractive labelled cartons. This brings the marketing of seed into line with other countries growing for sale.

Kenaf (Hibiscus cannabinus). The interest shown in this crop in the 1957-58 season was maintained during the 1958-59 season when some 1,500 acres were planted, an increase of approximately 1,000 acres as compared with the previous season. Groups of farmers in the principal maize growing districts were selected so that their combined acreage totalled approximately 200 acres. This was done for ease of supervision and advice. Taking into consideration the fact that kenaf was an entirely new crop and that the only seed available in large quantities was very mixed, with the result that it matured unevenly (which added to the difficulties of de-ribboning), the crop showed very considerable promise as a supplementary crop to maize. Yields of fibre naturally varied from farm to farm, as they do with all crops, but the better farmers produced satisfactory yields, which no doubt could be improved upon with increased knowledge of the crop and by planting higher yielding commercially pure varieties.

The Interim Fibre Committee which held its first meeting in August, 1958 and of which the Assistant Director of Research and Specialist Services is Chairman, has done a great deal of work in co-ordinating all aspects of fibre production. Among these are the further development of the Bell decorticating machine and the introduction and trial of the Seiga harvester from Denmark. This latter machine is the complete answer to the harvesting problems. The stage therefore seemed set fair for a steady expansion of the kenaf industry and it was with a great deal of disappointment that it was heard that the Umtali Jute Mills were to

close down, as it was these mills which would have absorbed the fibre produced. Unless an export market can be developed, there appears to be no prospect of any future for kenaf as a crop in the arable rotation. In the meantime agronomic experiments will continue to be conducted so that, if by any chance kenaf is grown again, this Department will have ready available all the information necessary.

Castor Bean. Castor bean is a crop which it is considered could occupy a fairly important part in the farming economy, especially in the drier areas. The country has been very well mapped by the Agronomy Staff at Matopos Research Station with regard to the most suitable areas for growing this crop, and a considerable amount of work has been done, also at Matopos, on the agronomic aspects of the crop.

World supply of castor beans falls far short of demand so that there is no doubt about the crop being sold, but farmers are not keen on growing it at present owing to attack by diseases and insect pests which reduce yields considerably. The price offered also is not considered attractive as compared with that paid for other crops such as maize and tobacco.

Groundnut Research. In 1957 examination of groundnut material at the Seed Testing Laboratory revealed that very few Southern Rhodesian samples, whether European or African grown, were up to the standard set by the Grain Marketing Board under their pilot scheme for the export of nuts of confectionery quality.

Arrangements were therefore made for the collection in the field of single plant selections at harvest and these were brought to the Seed Testing Laboratory for study. This material was made ready for planting in observation plots and in September, 1958, a series of regional trials throughout Southern Rhodesia was started, and land at Henderson Research Station was used for the planting of the progeny of the single plant selections.

The general conclusion reached after laboratory examination of the produce from trials was that in all areas early sowing is better than late sowing, that in the wetter areas of Mashonaland there is no difference in yielding ability between an early and a late type, other factors being equal, but that in the drier areas and particularly in Southern Mashonaland and Matabeleland an early variety is better than a late variety. As a whole, Southern Rhodesia is best suited to early varieties early sown and lifted at their correct maturations.

The material collected in 1958 covered a wide range of varieties and reflected the very mixed nature of the native Rhodesian stocks. Even the European grown stocks proved mixed in the sense that they were not of pure strains even if varietally homogeneous.

During the growing season notes on plant habit and the incidence of pests and diseases were made. The possibility that resistance to *Cercospora* sp. and *Rosette* may occur in these stocks was noted.

A total of 50 progeny were retained for further study; of these 25 are early and 25 are late maturing. They will enter progeny trials in 1959-60. The balance of the material was bulked to form a range of synthetic varieties for multiplication and testing.

By courtesy of the Department of Agriculture, Nyasaland, two promising late types suited to peasant cultivation have been imported for trial in Mashonaland. Another has been obtained from Northern Rhodesia for a similar purpose. The Plant Breeder at Mount Makulu Research Station, Northern Rhodesia, has supplied the entire range of material from the Bunting collection which approximates to the early successful types common in Southern Rhodesia. A total of 98 varieties or strains are available for trial in 1959-60 from this material.

Agricultural Shows. The Assistant Director of Research and Specialist Services judged the maize and agricultural produce and district exhibit sections at the Salisbury, Bulawayo, Gwelo, Umtali, Bindura, Lomagundi and Lusaka shows. There has been a considerable reduction in the number of exhibits at all Shows, especially in the agricultural produce sections. With one or two exceptions the standard of exhibits was disappointing and the wave of enthusiasm which was characteristic of the immediate post-war years seems to have died down.

I am indebted to the Director of Meteorological Services for the information supplied on seasonal conditions.

ANIMAL PRODUCTION

J. C. RAATH, *Chief Animal Husbandry Officer.*

The year under review has generally been a more difficult season for cattle production. Rains have been more erratic in nature and ceased earlier in the year. The grass lost its feeding value rapidly and this resulted in poor grazing conditions in the latter part of the winter and spring. Consequently stock lost heavily in weight and at the end of the season many cattle were in poor condition. During the last number of years and particularly in the year under review intensive propaganda has been put out by the Department to emphasize the importance of winter supplementary feeding. Producers who responded to the advice proved conclusively that it is not only economic in good years, but was particularly important in poor seasons when large scale mortality can occur.

THE BEEF INDUSTRY

Below are given figures for the total cattle population in the Federation as well as some details of the European owned cattle population in Southern Rhodesia over the past five years.

NUMBERS OF EUROPEAN AND AFRICAN OWNED CATTLE IN THE FEDERATION (IN THOUSANDS)

Year	Federal State		S. Rhodesia		N. Rhodesia		Nyasaland	
	European owned	African owned	E. owned	A. owned	E. owned	A. owned	E. owned	A. owned
1954 . . .	1,367	2,988	1,227	1,850	130	855	10	283
1955 . . .	1,381	3,069	1,246	1,901	125	871	10	297
1956 . . .	1,493	3,110	1,344	1,910	139	872	10	308
1957 . . .	1,500	3,190	1,434	1,981	155	892	11	317
1958 . . .	1,687	3,320	1,506	2,074	167	917	14	329

DETAILS OF EUROPEAN OWNED CATTLE IN SOUTHERN RHODESIA

Year	Total Number	Number of Cows	Number of Calves	Total Losses
1954 . . .	1,227,066	430,701	207,196	57,251
1955 . . .	1,246,254	449,306	206,746	65,043
1956 . . .	1,344,136	485,926	235,071	54,846
1957 . . .	1,434,115	524,291	270,114	57 443
1958 . . .	1,506,199	563,426	269,384	62,567

A substantial increase took place in the total cattle population of the Federation during 1958. The improvement in cattle numbers was general in all territories. Details of the European owned cattled in Southern Rhodesia indicate particularly encouraging increases in breeding cows, while losses remain at a satisfactory low level.

Supplies of Slaughter Stock. The following figures indicate the total supply of slaughter cattle from European and native sources in the Federation, but exclude cattle slaughtered for consumption in African reserves.

SUPPLIES OF SLAUGHTER CATTLE

TOTAL NUMBER OF CATTLE SLAUGHTERED

Year	Federal State	Southern Rhodesia	Northern Rhodesia	Nyasaland
1954 . . .	334,353	256,271	54,936	23,146
1955 . . .	323,683	260,430	40,113	23,140
1956 . . .	303,012	237,069	39,613	26,660
1957 . . .	330,717	264,355	37,613	28,749
1958 . . .	351,545	282,030	40,316	29,149

NUMBERS AND GRADES OF CATTLE SLAUGHTERED IN THE CONTROLLED AREAS OF SOUTHERN RHODESIA FOR THE YEAR ENDING 30TH SEPTEMBER, 1959

Grade	Oxen	Cows & Heifers	Bulls	Total 1959	Total 1958
Rhodesia Best	2,768	351	—	3,119	2,665
Imperial	10,264	756	—	11,020	8,614
Standard A	48,066	4,384	—	52,450	39,180
G.A.Q.	46,110	29,221	—	75,331	56,692
F.A.Q.	22,548	18,148	—	40,696	26,901
Compound	18,766	15,325	2,390	36,481	28,725
Inferior	2,976	7,668	128	10,772	12,239
TOTAL	151,498	75,853	2,518	229,869	175,016

COMBINED TOTALS FOR PRIVATE BUTCHERS

Grade	Oxen	Cows & Heifers	Bulls	Total 1959	Total 1958
Rhodesia Best	388	173	—	561	426
Imperial	1,679	414	—	2,093	1,990
A Grade	4,152	1,640	—	5,792	4,470
G.A.Q.	4,881	6,799	—	11,680	8,826
F.A.Q.	2,792	4,164	—	6,956	4,695
Compound	3,603	4,405	1,042	9,050	7,375
Inferior	234	1,491	21	1,746	1,779
TOTAL	17,729	19,086	1,063	37,878	29,561

GRADE PERCENTAGES OF CATTLE SLAUGHTERED IN CONTROLLED AREAS

Grade	C.S.C.		Private Butchers		Total Numbers	
	No.	%	No.	%	1959	1958
Rhodesia Best	3,119	1·36	561	1·48	3,680	3,091
Imperial	11,020	4·79	2,093	5·52	13,113	10,604
A Grade	52,450	22·82	5,792	15·29	58,242	43,650
G.A.Q.	75,331	32·77	11,680	30·84	87,011	65,518
F.A.Q.	40,696	17·70	6,956	18·37	47,651	31,596
Compound	36,481	15·87	9,050	23·89	45,531	36,100
Inferior	10,772	4·69	1,746	4·61	12,518	14,100
TOTAL	229,869	—	37,878	—	267,747	204,577

Total supplies of slaughter stock during 1958, exceeded the record numbers of the previous year by over 50,000 head. The highest number of cattle on record were marketed in the controlled areas of Southern Rhodesia during 1959. The Cold Storage Commission increased its turnover of cattle by 54,000 head. The percentage of the different grades remained constant. Total supplies of beef were well maintained throughout the year, but the higher grades of beef were again in short supply during the Christmas period. No changes were made in grading or in the retail marketing of beef. The C.S.C. slaughtered 3,074 calves and private butchers 9,856 during the year. The slaughtering of immature male stock was again at a high level (6,598) compared with 6,547 in the previous year. In addition 1,883 tollies weighing between 100 and 200 lb. c.d.w. were slaughtered. Although these tollies are normally classified as compounds they are sold as veal in the retail trade. An alarming increase has taken place in the slaughter of suitable breeding stock (8,784) compared with 2,705 for the previous year. This presents a difficult marketing problem, because young female stock realize much higher prices as beef than as breeding stock.

Prices of Slaughter Stock. A new long-term cattle price agreement with the Rhodesia National Farmers' Union was successfully concluded during the year. The agreement provides for greater elasticity in price fixation, while it retains the desirable feature of a long term price guarantee which has been such an important factor in ensuring confidence in the industry. A price increase of 2½ per cent. was granted to cattle producers. Price differentials between the different grades were left undisturbed, but in order to encourage production during the difficult months of the year certain alterations were made to the

seasonal price structure, which had the effect of advancing the high price period into the middle of December.

Owing to delays in negotiating the long-term cattle agreement, interim prices were published in March and April based on a straight 2½ per cent. increase. From the beginning of May the price structure incorporated the 2½ per cent. increase as well as the seasonal price changes.

Production and Marketing. The cattle industry continues to expand at a substantial rate. Beef produced in the Federation now exceeds the requirements of the country by approximately 10 per cent. As predicted last year it became necessary to find export markets for the surplus beef in order to allow for a sustained development of the industry. This course of action is essential to ensure that the industry would develop along lines which will ultimately provide the quantity of beef for the increased local consumption anticipated within the Federation. In addition the industry can play an increasingly important part in earning foreign exchange. During the latter part of the year the Ministry and the Cold Storage Commission independently examined markets in the United Kingdom and on the Continent with the view of expanding the export of beef products. As a result of these investigations it became evident that the United Kingdom offered the best prospects in this respect. Trial consignments of beef were delivered to the United Kingdom markets at a very opportune time. Supplies of beef from the Argentine decreased and a considerable proportion of beef from Australia and New Zealand was marketed in the United States. This movement assisted the entry of Rhodesian beef into the United Kingdom markets, by creating a severe shortage and a corresponding increase in price.

Preparation, Condition and Quality of Beef. Rhodesian chilled beef arrives on the United Kingdom markets in very good condition. The handling and preparation except for minor criticisms has been favourably received. Beef carcases from the Federation are not as uniform as those from the Argentine. Quality varied, especially as far as conformation and finish is concerned. Some excellent quarters of beef have been exported and these have been considered perfectly suitable for the British market requirements. Other quarters have been too light in weight and have lacked the desired conformation and fat cover. It is necessary to improve the uniformity of Rhodesian beef to equal the best of our carcases inspected on the United Kingdom market. These carried a good fat cover but less than Argentine beef and were readily acceptable as being less wasteful.

Chilled beef is considered to be the most economic way of marketing our products, but it does present more difficulties in collection and preparation as well as shipping space. Prices for chilled beef have been very satisfactory but hinds sell separately approximately 1s. 0d. per lb. above fores and in future the major proportion will probably be shipped as hind quarters. Approximately 25 per cent. forequarters will be included essentially because these are in demand on certain provincial markets and also to fully utilize refrigeration space. Due to the excellent condition of Rhodesian beef on arrival in Britain it is considered that a longer period can be set aside for collection. This will enable producers from a wider area to participate in export and allow greater opportunity for selecting the desired article.

Of all the frozen products exported, boneless beef undoubtedly gives the best returns. The beef which is used in the manufacturing trade is mainly derived from the lower grades and from the buyers' point of view is exactly of the right quality having a minimum of fat and excellent colour. This product was very well received and its packing and presentation was considered to be the best on the market. It is important to mention that this product can be sold mainly on a c.i.f. basis thus avoiding heavy storage charges in the United Kingdom. Manufacturers hold stocks of boneless beef themselves and therefore continuity of supply is less important. Prices for boneless beef have been very good but the market fluctuates and is expected to ease somewhat in the future. Close contact with market conditions through the agents is necessary to make the best use of this market.

Much of the Rhodesian frozen beef seen on Smithfield and on the provincial market was of very high quality and equal to the requirements of the chilled beef trade. It is the intention to have a continuous supply of frozen beef available in the United Kingdom in order to supply buyers of Rhodesian beef if chilled beef is not available.

Regarding the quality of packing, the remarks made under boneless beef apply equally to offals. Ox livers from other sources are equivalent in quality to those from the Federation, but our offals command a premium in price purely on account of the excellent packing.

Requirements of the United Kingdom Market for Chilled Beef. The ideal carcase for present day British requirements should weigh 560 lb. c.d.w. giving a quarter of 140 lb. with a good conformation and good finish, but not wastefully fat. An inspection of many Rhodesian carcases on the United Kingdom market revealed the fact that quarters weighing less than 130 lb. usually lacked the required conformation and finish. On the other hand excessive fat is not required and many quarters of Rhodesian beef were judged to be well suited to the market's requirements because they did not carry so much waste.

Nevertheless too much emphasis has been placed on the production of lean beef in the local market. Carcases classified as lean beef in Rhodesia will be considered immature and unfinished in the United Kingdom while those with rather too much cover for the local market will be perfectly suitable for the present day British requirements. In this respect British and Rhodesian requirements tend to be complementary and the United Kingdom provides a welcome outlet for the better quality beef produced in this country.

Age is relatively unimportant at this stage but it remains necessary in order to encourage expansion in local production to give preference to younger animals not exceeding 4½ years of age. It must also be expected that with improvement in the supply position in future age may again play a more important part in quality determination. There is no need to disturb the present grading system in the country because carcases of the quality required can be selected from all three top grades.

Rhodesian producers should aim at the production of a carcase with good conformation and finish and a minimum of 520 lb. c.d.w. In practice this can readily be achieved with steers weighing 1,000 lb. live weight and more and of a desirable conformation, with a fat covering equivalent to Rhodesia Best, Imperial and the better finished A grades.

The production of light immature unfinished animals must be discouraged, because it constitutes a national waste. A considerable increase has taken place in animals of this type many of which with some additional attention, feeding and management can be suitable export material.

Long-term price trends are always difficult to forecast, but informed opinion in Britain considers that prices will remain at a reasonably high level for the next two years and that beef has the best long-term prospects of all livestock products. During this period it is essential for Rhodesian beef to become firmly established on the British market. Volume of supplies in relation to demand is the major factor determining price levels for imported beef and any large increase in supplies from the main exporting countries must affect price levels. In order to establish a place on the market, continuity of supplies is absolutely essential and consistency in quality will become of paramount importance when greater supplies reach the market. Advantage can be taken of seasonal shortages in Britain by exporting larger quantities of beef from February to July which also corresponds with the lower priced period in the Federation.

Future Prospects. In discussing the future prospects for Rhodesian beef on the British market certain aspects of the potential production and exports of other countries must be considered in order to get a clear picture of the position.

The following table indicates the total volume of meat handled on the United Kingdom market from home produced and imported beef as well as the sources of importation.

BEEF: (Figures in '000 tons)

	1939	1954	1955	1956	1957	1958
Home Production	604·6	752·1	703·9	806·0	821·8	814·0
Net Imports	588·7	269·0	351·9	439·2	460·0	402·4

SOURCES OF IMPORT OF BEEF, VEAL INTO U.K. ('000 tons)

Source	1938	1954	1955	1956	1957	1958
Beef (chilled)						
Australia	26·4	0·1	4·9	4·8	9·8	7·4
New Zealand	18·0	5·4	15·8	23·7	21·9	2·8
Argentine	344·4	10·5	98·8	227·8	233·1	228·7
Other Countries	59·4	3·0	0·2	2·4	6·2	1·3
TOTAL	448·2	19·0	119·8	258·7	273·7	240·2
Beef (frozen)						
Australia	82·7	83·3	110·5	95·0	121·8	116·2
New Zealand	27·2	43·2	38·0	50·1	30·3	9·8
Argentine	9·9	79·5	58·9	20·5	23·7	26·9
Other Countries	7·6	40·7	16·8	8·5	4·6	4·3
TOTAL	127·4	246·7	224·2	174·1	180·2	157·1

Compared with the pre-war figures beef importations have dropped 180,000 tons while home production has increased by 200,000 tons. This represents an increase of 30 per cent. but the rate of increase has slowed down and home production is not expected to expand to any great extent in the future.

The Argentine has a colossal cattle industry producing some 1,000,000 tons of beef per annum. It is a country with very favourable climatic and nutritional conditions for beef production and beef exports feature prominently in the country's earnings of foreign exchange. It is capable of very rapid expansion in beef production and in two years could be back on the British market with greater quantities of beef. On the other hand local expansion and industrial development could absorb more beef on the home market. In the Argentine beef consumption is 190 lb. per person per annum. If it becomes necessary for various reasons to increase exports, local consumption could be decreased and for every 10 lb. reduction per head of population, 80,000 tons additional beef becomes available for export, an amount almost equivalent to the total production of beef, in the Federation. These figures of beef production in the Argentine are astronomical in relation to our country and make effective long-term forecasts very difficult. All that can be concluded is that with the expanding market in Britain itself the small quantity available from Rhodesia should be easily absorbed, but any large export by the Argentine would most certainly result in lower prices. Australia also has a considerable potential for beef production, and any return of Australian beef from the U.S.A. markets to Britain could materially affect the volume of beef available and consequently the price. It is not entirely within the scope of this report to comment on the predominant position of the fat lamb in the New Zealand livestock industry as well as the prominent place held by the Jersey cow in butterfat production.

It is, however, relevant to mention that any change in the pattern of livestock production in New Zealand can materially affect the volume of beef and pork imported into the United Kingdom.

It was clear from discussions with the New Zealand Meat Board that doubts are already entering the minds of these people in connection with the opportunist market in the U.S.A. It must be anticipated that New Zealand may soon seriously consider a return to the more stable long-term United Kingdom market.

In addition, changes in the production pattern in New Zealand can produce much bigger quantities of beef. This can be brought about by replacing the Jersey with heavier and quicker growing dairy cattle which can still produce the same amount of butterfat but can be used effectively for crossing purposes with beef cattle, to produce beef in large quantities ideally suited to the British market.

To counteract the possibilities of an increased volume of beef on the world market informed opinion forecast a continuous expansion in world beef consumption. With rising standards of living and increased populations, greater industrialization and decreasing areas in the world suitable for beef production, the general long-term prospects for beef are more favourable than for any other livestock product.

PIGS

Trends in pig production are still difficult to analyse because of incomplete census returns. It does appear from the following tables as if a general increase has taken place in the pig population as well as in the number of pigs coming forward for slaughter.

NUMBER OF PIGS IN THE FEDERATION ('000)

Year	Federal State		Southern Rhodesia		Northern Rhodesia		Nyasaland	
	European	African	European	African	European	African	European	African
1954 . .	75	162	64	47	9	34	2	81
1955 . .	65	151	53	46	10	30	2	75
1956 . .	65	162	50	47	13	40	2	75
1957 . .	80	188	59	57	18	44	3	87
1958 . .	78	182	58	56	17	46	3	80

SLAUGHTERINGS OF PIGS OVER THE PAST FIVE YEARS

Year	Federal State	Southern Rhodesia	Northern Rhodesia	Nyasaland
1954	136,179	121,212	10,123	4,844
1955	120,441	102,260	12,697	5,484
1956	113,205	92,438	15,185	5,582
1957	115,870	94,332	15,410	6,128
1958	142,938	113,635	21,069	8,234

PIGS SLAUGHTERED AND GRADED IN THE CONTROLLED AREAS OF SOUTHERN RHODESIA

A. Combined Totals for Colcom Products

Grade	Baconers		Porkers		Cutters	
	Number	%	Number	%	Number	%
A	44,641	79·49	14,576	57·79	1,732	34·76
B	4,897	8·72	4,369	17·32	887	17·80
C	1,427	2·54	—	—	—	—
L	2,127	3·79	349	1·38	30	·60
X	2,990	5·32	5,248	20·82	2,259	45·33
Inferior	81	·14	678	2·69	75	1·51
Total	56,163	—	25,220	—	4,983	—

Grade	Underweight Pigs		Overweight Baconers	Manufacturing Pigs		Boars	
	No.	%	No.	No.	%	No.	%
A	—	—	—	3,447	81·86	301	90·66
B	473	27·31	768	598	14·20	31	9·34
L	75	4·33	—	—	—	—	—
X	776	44·80	—	—	—	—	—
Inferior	408	23·56	—	166	3·94	—	—
Total	1,732	—	768	4,211	—	332	—

B. Combined Totals for Private Butchers

Grade	Baconers		Porkers		Cutters	
	No.	%	No.	%	No.	%
A	364	—	2,942	15·96	424	11·18
B	114	—	1,288	6·99	292	7·70
C	10	—	—	—	—	—
L	1	—	80	0·43	27	0·71
X	1,532	—	12,210	66·23	2,727	71·90
Inferior	203	—	1,916	10·39	323	8·51
Total	2,224	—	18,436	—	3,793	—

Grade	Underweight Pigs		Manufacturing Pigs	
	Number	%	Number	%
A	—	—	728	85·75
B	703	13·72	52	6·12
L	13	0·25	—	—
X	2,962	57·81	—	—
Inferior	1,446	28·22	69	8·13
Total	5,124	—	849	—

During 1959 Colcom products slaughtered a total of 93,396 pigs compared with 83,237 in the previous year; while for private butchers in controlled areas numbers increased from 27,609 to 30,426. No changes were made in the grading system during the year and only minor alterations took place in the price structure. The unbalanced price structure between porkers and baconers still creates difficulties as regards rapid price adjustments sometimes required to encourage either pork or bacon production.

Sufficient pig products were produced during the year to meet the requirements of the Federation. Export possibilities under present conditions are not attractive because local prices are high in relation to any probable realization on likely export markets.

Efforts to reduce the cost of pig production have been largely offset by the removal of the maize subsidy.

This has made many producers realize the importance of relying on home produced foodstuffs and to purchase only the minimum requirements necessary to balance their rations. The local increase in feed costs is contrary to world trends. Increased use of home grown food in an endeavour to reduce costs can lead to an increased proportion of maize in pig rations, which will have a detrimental effect on the quality of the fat. It is essential to maintain standards of quality in pig production. This principle on which the industry has based its development for many years is steadily being undermined by the large number of poor quality pigs coming on to the market and sold to the public at much higher prices than allowed by retail control. This development is detrimental to the industry and harmful to both European and African producers of high quality pigs.

Progress has been slow in developing suitable feed to replace maize in pig rations. It constitutes an important limiting factor in quality production particularly when export possibilities are considered. It is in the interest of the industry and of agriculture in general as well as for economic production that there should be greater integration between pigs and other branches of agriculture that can contribute materially towards more efficient and economic pig feeding.

The acquisition of modern processing plant, for which plans are well in hand, will be of great benefit to the industry. A new Pig Industry Act was passed during the year. These steps to federalize the pig industry will bring about greater integration of control and can assist in planning greater development of the industry.

Progeny Testing. Interest in the progeny testing scheme for pigs has been widespread. Pedigree Breeders have had twenty-two litter groups tested. The number of applications for tests to be carried out was considerably greater. Approximately half these applications were disqualified as a result of failure to attain the high standards required for entry. A considerable proportion of these were disallowed for not reaching the minimum weight or number at weaning. Commercial producers from all parts of the Federation have displayed great interest in the information available concerning boars, which have been tested, and in the use of the records for the selection of breeding stock to suit their particular requirements.

A full report on the progeny testings will be published in the *Rhodesia Agricultural Journal*. The following table gives a summary of the main results in comparison with figures obtained in Britain taken from the 1958 Annual Report of the National Pig Progeny Testing Board.

	Rhodesia 1958/59		Britain 1958	
	Large White	Landrace	Large White	Landrace
Feed conversion	3·23	3·51	3·31	3·35
Length mm.	801·2	833·2	803	810
Age at slaughter (days)	195·8	197	176	171
Backfat Thickness mm. Shoulder	42·3	36·5	46	43
Backfat Thickness mm. Middle	22·7	22·0	21	21
Backfat Thickness mm. Rump	26·1	24·6	26	25

SHEEP

Sheep production is increasing steadily. As the country develops sheep can be expected to play a more important part particularly on mixed farms. During

the year proposals were put forward by producers for the introduction of a grading system for sheep designed to encourage the production of higher quality carcases.

GENERAL

The Rhodesia and Nyasaland Standard Association completed their standards for feeding stuffs during the year, in relation to balanced rations for cattle, pigs and poultry. These standards have been published and feed manufacturers who become members of the Association and comply with the minimum requirements laid down will be able to use the Mark of the Association. This will ensure that good quality balanced rations will be available for most classes of livestock.

Close co-operation was maintained with the Extension Services during the year. Numerous cattle courses were arranged for farmers at which Animal Husbandry Officers gave lectures on all aspects of efficient animal production.

THE DAIRY INDUSTRY

R. G. JONES, *Chief Dairy Officer*

DAIRYING SEASON

This has been another record year for milk production in Southern and Northern Rhodesia. Although weather conditions varied in different areas and rainfall was rather erratic at times, milk production in all areas showed a substantial increase over previous years. The wet season ended rather early necessitating early feeding of winter rations but most farmers were able to conserve adequate supplies to last until the end of the season. However, if the rains are late in the 1959-60 season there is some danger that food supplies will not be entirely adequate. The need for adequate provision of food to meet conditions of late onset of rain and possible drought should be apparent to all livestock farmers and particularly to dairy farmers.

PRODUCTION OF DAIRY PRODUCE

Estimated total milk production increased by over two and a half million gallons of which about one and a half million gallons represents increased supplies to the Dairy Marketing Board in Southern Rhodesia and over half a million gallons represents increased supplies to the Co-operative Creameries in Northern Rhodesia. It is evident that the development of the dairy industries of Southern and Northern Rhodesia is continuing along the lines of the disposal of whole milk of farms to one or other of these organizations through which milk producer price guarantees are operated. Both organizations are now facing serious problems concerned with the economic usage of milk surplus to liquid milk requirements. Most of this surplus milk has been used for the manufacture of cheese, but efforts are being made to increase sales of skim milk in liquid form—both sweet and sour—in urban areas, while in Southern Rhodesia the Dairy Marketing Board skim milk drying plant at Gwelo is assuming an increasing importance in the pattern of the industry. Although sales of sterilized milk are gradually increasing in both territories the quantity of milk disposed of in this way remains comparatively small. Sterilized whole milk and flavoured skim milk are being produced.

During the period under review about 283 tons of cheese were exported from the Federation to the Union of South Africa which was short of cheese, but the position there has changed and cheese will be exported from South Africa during the coming season. Arrangements have been made for the export of further quantities of cheese to South Africa during the coming season and thus to participate in this export programme as a temporary measure to dispose of the excess of cheese which will have to be manufactured.

It is anticipated that a dried milk factory will be established by Nestles in Salisbury by the end of 1960 and that this factory will absorb at least one and a quarter million gallons of milk per annum for the manufacture of dried whole milk and baby food specialities.

Tables I and II give production figures for the main commodities in Southern and Northern Rhodesia respectively. These figures do not include the quantities of butter and cheese produced on farms which are relatively small and would not materially alter the picture.

TABLE I

DAIRY PRODUCTION, 1920–1959 — SOUTHERN RHODESIA

Year	Butter 1,000 lb.	Cheese 1,000 lb.	Skim Milk Powder (*b*) 1,000 lb.	Liquid Milk (*a*) 1,000 galls.	Total Gallons
1920	600	79	—	258	2,000,000
1930	1,768	163	—	1,008	6,100,000
1940	1,686	383	—	2,095	6,910,000
1945	1,224	702	—	3,848	7,750,000
1950	900	394	—	5,720	9,000,000
1954/55	1,096	1,267	—	7,632	12,514,000
1955/56	1,083	2,168	—	8,050	13,202,000
1956/57	1,387	2,050	137	9,100	14,900,000
1957/58	1,437	2,240	438	9,600	15,700,000
1958/59 (*c*)	1,881	2,693	934	9,900	17,600,000

(*a*) Milk available for use as liquid milk, skim milk, fresh cream and ice-cream.
(*b*) Production of skim milk powder started during 1956/57.
(*c*) Preliminary figures.

TABLE II

DAIRY PRODUCTION, 1956–1959 — NORTHERN RHODESIA

Year	Butter 1,000 lb.	Cheese 1,000 lb.	Liquid Milk (*a*) 1,000 galls.	Total Gallons
1956/57	40	497	1,750	2,400,000
1957/58	56	426	2,330	3,000,000
1958/59 (*b*) . . .	129	851	2,500	3,800,000

(*a*) Milk available for use as liquid milk, skim milk, fresh cream and ice-cream.
(*b*) Preliminary figures.

The general structure of the industry has not changed during the year and the main growth of the industry is reflected in the operations of the Dairy Marketing Board in Southern Rhodesia and the Co-operative Creameries in Northern Rhodesia. The Gazaland Co-operative Cheese Factories in Chipinga and the Zambezi Co-operative Dairies in Livingstone continued to operate at approximately the same level of through-put as in the previous year. Tables III and IV show the approximate number of suppliers and the total intake of milk in recent years of the Dairy Marketing Board and the Co-operative Creameries of Northern Rhodesia.

TABLE III

THE DAIRY MARKETING BOARD (SOUTHERN RHODESIA)

Year	Number of Suppliers (August)	Total Milk Supplied (Gallons)
1952/53 . . .	280	5,638,000
1953/54 . . .	322	6,488,000
1954/55 . . .	364	7,817,000
1955/56 . . .	403	8,852,000
1956/57 . . .	416	9,736,000
1957/58 . . .	459	10,794,000
1958/59 . . .	522	12,379,000

TABLE IV

THE CO-OPERATIVE CREAMERIES OF NORTHERN RHODESIA

Year	Number of Suppliers (August)	Total Milk Supplied (Gallons)
1955/56 . . .	118	1,431,000
1956/57 . . .	125	1,880,000
1957/58 . . .	123	2,211,000
1958/59 . . .	135	2,867,000

It will be observed that increased production was due to a further increase in average production per supplier as well as to an increase in the number of suppliers. The apparent small increase in average supplies per supplier in Southern Rhodesia can be attributed to the large number of additional suppliers starting during the year.

Creameries, Butter Production and Consumption. All butter manufacture, other than a very small amount of farm produced butter in the remote areas, and all importation of butter was done by the four registered creameries situated at Lusaka, Salisbury, Gwelo and Umtali. Local manufacture of butter has increased further mainly due to the increased amount of milk surplus to whole milk requirements separated by the Dairy Marketing Board in Southern Rhodesia and the Co-operative Creameries of Northern Rhodesia, although it appears that there was also a small increase in the supplies of butterfat direct from farmers. The increase in sales of skim milk in urban areas in both territories and the manufacture of skim milk powder by the Dairy Marketing Board resulting in increased butter production coupled with a decrease in apparent consumption of butter has had the effect of reducing importation of butter well below that of previous years.

Tables V and VI give the production and apparent consumption of butter and illustrate the changing situation. The fall in apparent consumption of butter is due mainly to increasing consumption of margarine containing 10 per cent. butter. The figures for the last three years include farm sales.

TABLE V

PRODUCTION AND APPARENT CONSUMPTION OF BUTTER — SOUTHERN RHODESIA

Year	*Production* 1,000 *lb.*	*Consumption* 1,000 *lb.*	*Shortfall met by importation* 1,000 *lb.*
1950/51	767	2,643	1,876
1951/52	975	3,062	2,087
1952/53	964	3,207	2,243
1953/54	906	3,232	2,326
1954/55	1,096	3,482	2,386
1955/56	1,083	3,650	2,567
1956/57	1,398	3,997	2,599
1957/58	1,445	3,800	2,355
1958/59 (*a*)	1,891	3,544	1,653

(*a*) Preliminary figures.

TABLE VI

PRODUCTION AND APPARENT CONSUMPTION OF BUTTER — NORTHERN RHODESIA

Year	*Production* 1,000 *lb.*	*Consumption* 1,000 *lb.*	*Shortfall met by importation* 1,000 *lb.*
1956/57	44	1,678	1,634
1957/58	65	1,532	1,467
1958/59 (*a*)	139	1,423	1,284

(*a*) Preliminary figures.

Butter was imported from Kenya and South Africa and New Zealand in the following proportions:—

	Southern Rhodesia	*Northern Rhodesia*
Kenya	39·4	32·3
South Africa	49·5	67·7
New Zealand	11·1	nil

For most of the year all margarine containing 10 per cent. butter was imported but the manufacture of this commodity in Salisbury was started before the end of the year. It is estimated that further importation will be almost negligible and locally produced butter will be used in this product in future. Special arrangements have been made to manufacture butter to the specification required for this purpose.

At the beginning of 1959 wholesale and retail prices of 1st and 2nd grade butter were reduced by 3d. per lb. in Southern Rhodesia and 4d. per lb. in Northern Rhodesia thus bringing the prices into line in both territories.

The new maximum retail prices were as follows:—

First Grade	*Second Grade*
3s. 8d. per lb.	3s. 6d. per lb.

Minimum prices for butterfat supplied as cream to creameries remained the same as before, viz:

Southern Rhodesia	*First Grade Cream*	*Second Grade Cream*
January to March	3s. 0d. per lb.	2s. 9d. per lb.
April and December	3s. 10d. per lb.	3s. 7d. per lb.
May to November	4s. 8d. per lb.	4s. 5d. per lb.

Northern Rhodesia	*First Grade Cream*
January to June	3s. 6d. per lb.
July to December	4s. 3d. per lb.

There is no price control on other grades of butterfat and butter.

Grading of butter before sale has not yet been introduced in Northern Rhodesia but all butter is graded by Dairy Officers before sale in Southern Rhodesia.

Tables VII and VIII give the grades of butter produced as percentages of total manufacture.

TABLE VII

BUTTER GRADES AS PERCENTAGE OF TOTAL MANUFACTURE — SOUTHERN RHODESIA

Year	*First Grade per cent.*	*Second Grade per cent.*	*Third Grade per cent.*
1953/54	78·5	13·5	8·0
1954/55	87·0	9·0	4·0
1955/56	86·6	9·8	3·6
1956/57	87·2	8·6	4·2
1957/58	87·0	9·0	4·0
1958/59	88·0	9·0	3·0

TABLE VIII

BUTTER GRADES AS PERCENTAGE OF TOTAL MANUFACTURE — NORTHERN RHODESIA

Year	*First Grade per cent.*	*Second Grade per cent.*	*Third Grade per cent.*
1956/57 . . .	96	1	3
1957/58 . . .	96	3	1
1958/59 . . .	88	1	11

Cheese Factories, Cheese Production and Consumption. A new cheese factory operated by the Italo-Rhodesian Cheese Factory Ltd., and situated in Salisbury was registered early in 1959. This factory draws its milk supply from the Dairy Marketing Board and produces various Italian type cheeses.

The Dairy Marketing Board Cheese Factory at Gatooma produced only very small quantities of Roquefort type cheese on an experimental basis due to further alterations to the dairy which had to be extended to cater for the greatly increased throughput of milk. Most of the experimental cheese produced was of good quality and it is expected that production on a larger scale will be started during the coming season.

The Cheese Factories situated at Chipinga, Umtali, Salisbury, Gwelo, and Bulawayo all manufactured Cheddar and Gouda cheese according to demand and Gouda cheese manufacture was started at Mazabuka at the end of 1958. Prior to this the Mazabuka factory had produced only Cheddar cheese and Gouda cheese had been supplied from Southern Rhodesia. Cheese production at Gwelo was small owing to the fact that sufficient cheese was manufactured by other factories to more than meet local demand and most of the surplus milk at Gwelo was manufactured into butter and skim milk powder.

Total cheese production increased substantially and exceeded local demands. Cheddar cheese was exported to the Union of South Africa from both Northern and Southern Rhodesia and Gouda cheese was exported from Southern Rhodesia. A total of about 283 tons of cheese was exported of which 122 tons were exported from Northern Rhodesia and 161 tons from Southern Rhodesia.

Cheese was exported in small quantities to neighbouring territories and Nyasaland was supplied with its requirements of Cheddar and Gouda cheese from Southern Rhodesia.

The Dairy Marketing Board again exhibited cheese at the Rand Easter Show with notable success. Some cheese exhibited at the Kenya Royal Show in September also gained awards.

Cheddar cheese produced in Southern Rhodesia is graded by Dairy Officers before sale but there is no such statutory requirement in Northern Rhodesia. However, at the request of the Dairy Industry Control Board in South Africa all Cheddar cheese exported from Northern Rhodesia to South Africa was graded by the Senior Dairy Officer in Lusaka before despatch.

Table IX shows the percentage of each grade of Cheddar cheese manufactured and graded in Southern Rhodesia in the last five years.

TABLE IX

CHEDDAR CHEESE GRADINGS AS PERCENTAGE OF TOTAL CHEESE GRADED IN SOUTHERN RHODESIA

Year	*First Grade*	*Second Grade*	*Third and Below Grade*
1954/55 . . .	83·9	13·8	2·4
1955/56 . . .	94·9	4·2	0·9
1956/57 . . .	96·1	3·5	0·4
1957/58 . . .	97·3	2·4	0·3
1958/59 . . .	93·6	6·1	0·3

A comparatively small amount of farmhouse cheese was manufactured but only one farmer manufactured Cheddar cheese. This farmer and the Gazaland Co-operative Cheese Factory, Chipinga, were paid a special subsidy of 6d. per lb. on cheese produced.

Wholesale and retail prices for Cheddar and Gouda cheese remained the same as the previous year and the maximum retail price for 1st grade Cheddar and Gouda cheese was 2s. 11d. per lb. in Southern Rhodesia and 3s. 6d. per lb. in Northern Rhodesia.

Milk Supplies and Milk Prices. As stated previously in this report the main development of the dairy industry in both Southern and Northern Rhodesia is reflected in the intake of the Dairy Marketing Board in Southern Rhodesia and

the Co-operative Creameries in Northern Rhodesia. Tables X and XI show the milk intake of these two organizations in recent years and the quantity of milk used by them to meet local requirements for whole milk.

TABLE X

DAIRY MARKETING BOARD — SOUTHERN RHODESIA

Year	*Total Milk Intake,* 1,000 *Gallons*	*Apparent Consumption as Whole Milk,* 1,000 *Gallons*	*Surplus over Whole Milk Requirements,* 1,000 *Gallons*
1953/54 . .	6,488	5,462	1,026
1954/55 . .	7,817	5,941	1,876
1955/56 . .	8,852	6,388	2,464
1956/57 . .	9,736	6,654	3,082
1957/58 . .	10,794	7,158	3,636
1958/59 . .	12,379	7,348	5,031

TABLE XI

CO-OPERATIVE CREAMERIES OF NORTHERN RHODESIA

Year	*Total Milk Intake,* 1,000 *Gallons*	*Apparent Consumption as Whole Milk,* 1,000 *Gallons*	*Surplus over Whole Milk Requirements,* 1,000 *Gallons*
1956/57 . .	1,880	1,315	565
1957/58 . .	2,211	1,635	576
1958/59 . .	2,867	1,656	1,211

It will be observed that intake has increased at an appreciably greater rate than consumption of whole milk in both territories. Milk surplus to whole milk requirements is disposed of as skim milk (sweet and sour) dried skim milk, sterilized milk and cheese manufacture but as the value of milk for these purposes is less than that for whole milk sales there has been a fall in prices paid to producers.

On January 1st, 1959, the payment on quality scheme which has been operating in Southern Rhodesia for many years was introduced in Northern Rhodesia and from that date prices in each territory have been strictly comparable although separate pools are operated for each territory. During the year a new three-year running agreement on milk producer prices was negotiated between Government and the Rhodesia National Farmers' Union. This new agreement was brought into effect on 1st June, 1959. Under this agreement standard prices for milk used for whole milk sales and the "safety margin" or "essential surplus" remained the same and the only change was an increase in the "safety margin" in Northern Rhodesia from 243,000 gallons to 250,000 gallons per annum. This milk price agreement applies only to milk supplied to the Dairy Marketing Board in Southern Rhodesia and the Co-operative Creameries in Northern Rhodesia.

From 1st April, 1959, the bonus of up to 4d. per gallon payable to producers in Northern Rhodesia was discontinued in respect of producer retailers and from that date this bonus has been paid only to producers supplying the Zambezi Co-operative Dairies at Livingstone where the milk producer prices agreement does not apply.

Producer retailers continued to operate throughout both territories in the remote areas and also in the main centres where certain favourably placed producers operate in direct competition with the main distributing organizations. It is estimated that sales by producer retailers in the price controlled areas in Southern Rhodesia amount to about 5 per cent. of whole milk sales in those areas but on the Copperbelt about 33⅓ per cent. of the whole milk market is supplied by producer retailers.

The Gazaland Co-operative Cheese Factory in Chipinga supplies most of the local whole milk requirements of Chipinga and the Karoi Dairies supply Karoi and most of the milk requirements of Kariba.

Tables XII and XIII show the standard prices in Southern and Northern Rhodesia respectively, the actual pay-out for 1958-59 and the actual pay-out for the previous year as calculated without applying the individual effect on producer prices of the payment on quality scheme. Up to December, 1958, the prices in Northern Rhodesia were farm-gate prices and a special bonus applied but from 1st January, 1959, producers have been responsible for payment of the transport of their milk to the dairies and the special bonus has been discontinued.

Owing to the increase in supplies without a corresponding increase in sales of whole milk the average price paid for all milk was lower than in the previous year.

TABLE XII

SOUTHERN RHODESIA

Month	*Standard Price per Gallon* 1958/59	*Actual Pay-out Without Bonuses and Quality Payment per Gallon* (*a*) 1958/59	*Actual Pay-out Without Bonuses and Quality Payment per Gallon* (*b*) 1957/58
October	4s. 3d.	3s. 6·4d.	3s. 7·5d.
November	4s. 3d.	3s. 3·9d.	3s. 5·8d.
December	3s. 1d.	2s. 5·6d.	2s. 6·4d.
January	3s. 1d.	2s. 5·9d.	2s. 6·3d.
February	3s. 1d.	2s. 7·5d.	2s. 8·3d.
March	3s. 11d.	3s. 2·7d.	3s. 5·4d.
April	3s. 11d.	3s. 3·8d.	3s. 5·3d.
May	3s. 11d.	3s. 3·2d.	3s. 5·1d.
June	3s. 11d.	3s. 3·3d.	3s. 5·7d.(*c*)
July	4s. 3d.	3s. 5·3d.	3s. 8·9d.
August	4s. 3d.	3s. 4·2d.	3s. 7·8d.
September	4s. 3d.	3s. 3·4d.	3s. 6·4d.

(*c*) "Safety margin" was reduced to 62,500 gallons per month.

(*b*) These prices differ from those quoted in last year's report owing to a supplementary payment when actual realization value of surplus milk was established.

(*a*) Prices subject to adjustment when actual average realization value of surplus milk is established by the Dairy Marketing Board.

TABLE XIII

NORTHERN RHODESIA

Month	*Standard Price per Gallon* 1958/59	*Actual Pay-out Without Bonuses and Quality Payment per Gallon* 1958/59	*Actual Pay-out Without Bonuses and Quality Payment per Gallon* 1957/58
October	4s. 1d.	3s. 6d.	4s. 0d.
November	3s. 6d.	2s. 9·75d.	3s. 5d.
December	2s. 5d.	2s. 0·4d.	2s. 3·35d.
January	3s. 1d.(*a*)	2s. 6·1d.	2s. 2·17d.
February	3s. 1d.	2s. 7·5d.	2s. 3·48d.
March	3s. 11d.	3s. 3·4d.	3s. 5d.
April	3s. 11d.	3s. 2·9d.	3s. 3·75d.
May	3s. 11d.	3s. 2·2d.	3s. 3·2d.
June	3s. 11d.	3s. 1·2d.(*c*)	3s. 1·8d.(*b*)
July	4s. 3d.	3s. 3·1d.	3s. 7·5d.
August	4s. 3d.	3s. 3·2d.	3s. 6·7d.
September	4s. 3d.	3s. 5·7d.	3s. 7d.

(*a*) Payment on quality scheme introduced with Southern Rhodesia prices. Previous bonus scheme discontinued.

(*b*) Safety margin reduced to 20,250 gallons per month.

(*c*) Safety margin increased to 20,800 gallons per month.

Retail prices for milk are controlled by law in areas within seven miles of the main post offices in the main towns of Southern Rhodesia but there is no such price control in Northern Rhodesia although the prices charged by the Co-operative Creameries are agreed with the Government as these prices are a factor in determining subsidies. Retail prices remained unchanged until 1st June, 1959, when prices in Southern Rhodesia were increased by 1d. per pint and the subsidy correspondingly reduced. At the same time a levy equal to the increase in price of 8d. per gallon was imposed on milk sold by producer retailers in the price control areas. The proceeds of this levy are used to partly offset subsidy requirements.

Retail prices at the end of the year for cash sales were as follows:

Southern Rhodesia	8d. per pint
Northern Rhodesia	
Copperbelt	9½d. per pint
Midlands	8½d. per pint

Fresh Cream. No statistics for fresh cream sales are available but there were no reports of shortage of supply and the demand was met by the main dairies and by sales by producers direct to consumers or through agents in the towns. A good development is that most cream suppliers now put their names on the cream cartons and it is hoped that this will become a statutory requirement in the near future.

Dried Milk. The Dairy Marketing Board continued to produce dried skim milk at the Gwelo factory. These premises were extended and a new roller drier installed. This skim milk is sold in wholesale quantities in paper bags and in 1 lb. packets for the retail trade. This outlet for surplus milk is becoming increasingly important especially as it has the effect of reducing import requirements of butter which accounts for the largest proportion of imports of dairy produce.

Unfortunately, skim milk powder is subject to rather violent price fluctuations on the world market and it has been difficult to replace imports at an economical local price. This has resulted in stocks being accumulated at times and the necessity to vary prices in order to dispose of these stocks.

No dried whole milk or evaporated milk was produced but negotiations were continued with the Nestles organization and this company proposes to erect a factory in Salisbury for the production of dried whole milk towards the end of 1960.

Sterilized Milk. Sterilized milk was produced in Lusaka and in Bulawayo. In addition to sterilized whole milk sterilized flavoured skim milk was produced and in Lusaka sterilized fat reduced milk was produced. Sales of these commodities have shown relatively small increases and it is likely that expansion of this market will be slow.

Dairy Bonus Scheme. This scheme was continued in Southern Rhodesia and payments during the year under review which apply to production during the previous year amounted to approximately £12,160. Of this amount about £7,921 was paid on butterfat, and £4,238 on cheese milk in the Chipinga area where special conditions are applied. Consideration has been given to the desirability of continuing this scheme in its present or modified form but no decision has yet been reached.

MILK RECORDING

It has not been possible to extend the scheme to additional herds owing to no increase in staff of Milk Recorders and only semi-official recording was carried out in Northern Rhodesia.

Since the appointment of an additional clerical officer the processing of milk records has been speeded up and during the year the backlog was disposed of although this necessitated the services of a supernumerary typist for three months.

Although it has not been possible to increase the number of herds recorded the number of cows recorded has increased appreciably as can be seen by the number of completed lactations in Table XV.

Arrangements were made for the Dairy Officer specially appointed to take charge of Milk Records to go to England for a period of training with the Milk Marketing Boards in the coming year.

The results of the Milking Competitions show that good production standards can be achieved in the dairy herds of the Colony.

Tables XIV and XV give the production figures for the winners of the Milking Competitions and average production per cow recorded in recent years.

TABLE XIV

PRODUCTION OF WINNING HERDS IN MILKING COMPETITIONS, AVERAGE OF BEST 15 COWS IN THE HERD

Year	*Milk Section*	*Butterfat Section*
1951/52	15,207 lb.	493·2 lb.
1952/53	13,548 lb.	486·0 lb.
1953/54	12,917 lb.	440·8 lb.
1954/55	13,772 lb.	496·6 lb.
1955/56	14,551 lb.	486·1 lb.
1956/57	14,908 lb.	511·9 lb.
1957/58	14,863 lb.	503·6 lb.

TABLE XV

AVERAGE PRODUCTION PER COW — PEDIGREE AND GRADE HERDS

Year	Completed Lactations	Average Milk Production per Cow	Average Butterfat Production per Cow	Percentage Butter	Days
1951/52	5,436	6,412	244·1	3·81	279
1952/53	5,554	6,265	228·3	3·64	274
1953/54	5,798	6,583	236·1	3·59	279
1954/55	7,330	6,415	246·9	3·85	280
1955/56	8,095	6,400	250·5	3·91	277
1956/57	9,050	6,683	257·7	3·86	286
1957/58	9,783	6,674	260·5	3·79	277

The improvement in the average production per cow in recorded herds is indicative of improving herd management.

GENERAL

The transport of milk by road tanker from the Mazabuka and Lusaka areas to the Kitwe dairy for sale as wholemilk in the Copperbelt has continued and approximately 2,500 gallons per day were transferred in this way. No tanker transport has taken place in Southern Rhodesia but the Dairy Marketing Board is seriously considering the possibility of road tanker transport, particularly for the transport of surplus milk from the Gatooma and Que Que areas to Gwelo or Salisbury for manufacturing purposes.

Further structural alterations were carried out at Model Dairy, Bulawayo, mainly to increase cheese curing space, and minor improvements have been made at some of the other dairies. The alterations to the Gatooma dairy were completed and arrangements were made to cool all incoming milk so that surplus could be despatched to Gwelo without further treatment. Plans are in hand to increase the cooling capacity of this dairy in order to cater for the increasing throughput.

Hitherto only roller dried skim milk powder has been produced in Gwelo but the Dairy Marketing Board plans to install a spray drying plant in the coming season.

With the increasing production in Northern Rhodesia it will probably be necessary to extend cheesemaking facilities at the Mazabuka Dairy in the near future.

The building of the new dairy in Salisbury proceeded according to plan and new plant and equipment was ordered. Some of the new plant was installed by the end of September and it is envisaged that the dairy will be complete and ready for operation by February or March, 1960.

Exports of milk to Portuguese East Africa showed a further increase during the year and amounted to about 71,000 gallons as compared with about 55,000 gallons during the previous year.

Negotiations between the Farmers' Co-operative Industries Ltd., Salisbury, and the Dairy Marketing Board resulted in the Dairy Marketing Board taking over the creamery and ice-cream functions of the Salisbury Creamery at the beginning of July, 1959. The premises of the Salisbury Creamery are leased by the Dairy Marketing Board for a period of three years and continue to operate as a creamery and ice-cream factory.

In order to meet an increasing demand for chocolate coated ice cream a special machine is being installed at the Salisbury Creamery.

Two of the largest ice-cream manufacturers in Britain have been investigating the possibility of setting up ice-cream factories in the Federation and discussions have taken place between them and the Dairy Marketing Board.

An estimate of the radio-active fallout in the Federation is being carried out and for this purpose arrangements have been made for samples of milk to be collected at the various dairies during the coming year. These samples will be dried on the Gwelo milk drying plant and despatched by the Food Technologist along with samples of other foodstuffs to the United Kingdom for analysis.

A significant feature of milk production is the increase in the number of milking parlours being built. This development is accompanied by the installation of a large number of milking machines and the present trend is towards the use of "in churn" milking units. This system is very suitable for conditions in this area.

It has been decided to proceed with Federal dairy legislation in order to bring the present legislation up to date and so that dairy legislation will be the same in both Southern and Northern Rhodesia. The preparation of a new Federal Dairy Act was put in hand but it will be some time before the new legislation can be promulgated and it is likely that some amendments to present legislation will have to be made in the interim period.

DAIRY BRANCH ACTIVITIES

The work carried out by the Branch includes statutory inspections and registration of factories and farm dairies, grading of dairy produce, sampling and testing of milk both for the purposes of the scheme for the payment for milk on a quality basis and for advisory purposes, advisory work on production of milk and manufactured products, lecturing at Gwebi Agricultural College, judging of dairy produce at Agricultural Shows and operating the Milk Recording Scheme.

Dairy Officers also lectured on special aspects of dairying at short dairy courses run by the Department of Conservation and Extension.

With the growth of the dairy industry the work of the Branch increases annually. In addition to other duties over 16,000 samples of milk were tested during the year by Dairy Officers for the purposes of the payment on quality scheme for milk in addition to numerous other advisory and special tests to investigate various production problems.

It was decided that the milk prices and price structures in Northern and Southern Rhodesia should be brought into line on 1st January, 1959. In order to provide the additional services required for this purpose a Dairy Officer from Southern Rhodesia was transferred to Northern Rhodesia and the arrangement whereby a Dairy and Poultry Officer nominally on the staff of the Dairy Branch and seconded to the Department of Conservation and Extension in Northern Rhodesia was discontinued by the removal of this Officer from Dairy Branch establishment. An additional Dairy Officer post was created for the year 1959-60. A new Officer is being recruited and should assume duty in November, 1959.

The position at the end of the year under review was that there were two Dairy Officers and one Milk Recorder stationed in Lusaka, one Dairy Officer and one Milk Recorder at Gwelo, two Milk Recorders at Bulawayo, one Milk Recorder at Umtali, and the remainder of the staff at Salisbury. The Dairy Officers stationed at Lusaka cover Northern Rhodesia including the Livingstone and Victoria Falls area, the Dairy Officer stationed at Gwelo covers the Bulawayo area as well as Gwelo, Que Que and Fort Victoria and the remainder of Southern Rhodesia is covered by the Dairy Officers stationed at Salisbury.

The Chief Dairy Officer attended the XV International Dairy Congress in London in June and July, 1959, as the official delegate from the Federation. All meetings and sub-committees' meetings of the Dairy Marketing Board were attended by the Chief Dairy Officer or his deputy and numerous meetings of the R.N.F.U. and farmers' organizations were attended by Officers of the Branch.

In spite of the fact that two vacancies for Dairy Officers were filled during the previous year and an additional clerical officer was appointed the increasing duties have necessitated long hours of work to maintain services at an efficient level. The loyal and willing co-operation of all officers and staff in meeting all demands made upon them is deeply appreciated.

Various problems crop up periodically and under present conditions it is not possible to investigate these problems thoroughly. This position is unsatisfactory and although many problems are solved in a general way by drawing on experience and work done in other countries it should be made possible for the Branch to carry out a certain amount of investigational work so that the problems of the industry here may be more clearly appreciated on a scientific basis.

POULTRY

G. H. COOPER, *Chief Poultry Officer*

In general this year has been an improvement on the preceding two in respect of returns on poultry products. Prices for eggs and table poultry have increased slightly but the general trend has been firmer. Improved husbandry in many cases has been the main reason for better returns. It is evident that when margins of profit are low there is less speculative production, and improved husbandry by established producers is required. Many experienced producers have greater confidence in the industry and have put more capital into improvements.

PRODUCTION AND MARKETING

Eggs. Egg production followed the usual seasonal pattern, but for reasons which are obscure there was a greater fall in production during the winter than usual with a consequent higher price for several weeks than producers have had for some years. It is probable the prolonged summer caused unseasonable moulting amongst many pullet flocks, which will normally carry through well in production with lower temperatures.

The spring production caused the usual price drop but has not been prolonged and has not caused embarrassment except in the midlands area of Northern Rhodesia, where disposal of surplus has been difficult. Buyers of eggs for storage do not seem to have taken up this surplus to date.

Culling of flocks when prices drop is now universal practice due largely to the high price of feed and improved means of disposal. This has the immediate effect of steadying both the production and the price. In Southern Rhodesia particularly, producers are thus working to a programme of production dictated by experience in price trends.

There is room for considerable improvement in production per bird and also for increased consumption of eggs, though the latter is impossible to estimate due to the vast home production in this country.

The marketing of eggs has remained as in the past through wholesalers, retail outlets, and by direct sales to consumers or on contract. Wholesalers have taken up pullet egg production for pulping to supply bakers' requirements. This year insufficient pulp was available and imports were required for two months.

The chilled egg regulations under the Control of Goods Act were gazetted in December, 1958, requiring the stamping as "Chilled" of all eggs held in cold storage below 45°F. Cold storage plants must register annually and forward returns quarterly. Provision for inspection of plants is made. Returns indicate that very few eggs are being held in cold storage in Southern Rhodesia, and limited quantities only in Northern Rhodesia, which knowledge is of value should imports or exports be contemplated.

The proposed grading regulations have not been implemented. It is expected they will shortly emerge as recommended grades for both eggs and table poultry.

Table Poultry. This year has seen further expansion in broiler production. Our largest producer is now selling over 150,000 broilers per annum in the Salisbury market, which is a considerable achievement for one concern. Many smaller producers are selling improved quality birds and capital expenditure on processing equipment has increased. New ventures in processing and distribution of frozen birds have been started in Southern Rhodesia.

The supply position in Northern Rhodesia is still insufficient to meet the demand and imports from South Africa have been required. Some stocks have been shipped from Southern Rhodesia and severe criticism of the finishing and packing of the products of one firm were justified at one period, but there has also been some prejudice over the price factor. Government protection to local producers has been afforded in requiring all importers to furnish proof that local stocks were unavailable and to guarantee a price of 6d. per lb. in excess of the landed cost of South African birds before import permits were allowed. This is to even up the lower costs of production in South Africa. Production of table birds in both Southern and Northern Rhodesia is increasing and should soon satisfy requirements, when it is confidently expected that markets in the Congo and other neighbouring states can be exploited.

The prices paid for broilers remain steady at 3s. 0d. to 3s. 6d. per lb. dressed to the trade, and 2s. 3d. per lb. for roasters in Salisbury and the Copperbelt with lower prices ruling in other centres.

Locally produced turkeys were able to supply requirements in Southern Rhodesia for the Christmas season though quality improvement is necessary. Imports for Northern Rhodesia were required.

Ducks form a minor role in table poultry and may be considered a luxury article though consumption is increasing.

There is room for further expansion in table poultry production particularly in Northern Rhodesia; however, seasonal production in the spring is becoming heavy and storage is necessary to maintain prices.

The price of poultry to the consumer will have to come down to compete with other meats, but the retailers must bear the main reduction as their handling charges are excessive.

Stocks. The production of day-old chicks has increased considerably with the expansion of broiler production and also with the control placed on imports in Northern Rhodesia. The vast majority are produced in Southern Rhodesia, but two or three hatcheries are producing in Northern Rhodesia.

Most of the popular breeds and crosses are available. Sexed chicks are produced between March and September, when replacement pullets are required, but broiler producers have to use mixed chicks during the remainder of the year. Special strains of broiler stock have been imported.

The production of pedigree stock has not kept pace with the demand for chicks and, as the reward for improved stock is not as great as the multiplication of flock chicks, fewer producers are encouraged to this highly important side of the breeding programme. It would appear that for some time to come better stock will be produced by only a handful of enthusiasts and by superior imported strains after acclimatization.

FEEDS AND FEEDING

All feeds used in poultry rations have been in full supply except lucerne meal which, owing to a short crop in South Africa, was not available from August to October. Manufacturers had to increase the synthetic vitamin content of feeds in consequence but the yolk colour of eggs suffered in many instances where succulent greens were not available. The production of greater supplies of lucerne meal within the Federation is obviously important for stock feed requirements, particularly poultry.

The maize farmer who is able to make use of home grown maize with concentrates is in a position to produce poultry products more cheaply than producers who have to purchase all their feed. A figure of 36s. 0d. per bag for maize on the farm compared with 44s. 0d. for that in manufactured feeds significantly reduces production costs. There is therefore a tendency for poultry production to increase in the grain growing areas.

Manufactured feeds are generally of excellent quality and the registration of poultry feeds under the Farm Feeds Act has been carefully checked by this Branch. The Rhodesia and Nyasaland Standards Association published their requirements for stock feeds, including poultry, in August and members will adhere to these in 1960, which will provide further safeguards for consumers.

IMPORTS

The main item as in the past has been the importation of dressed poultry for the Copperbelt; however, there has been a reduction of 45,000 lb. in weight and £8,000 in value since 1957/58.

Imports of day-old chicks were greatly reduced by 30,000 and are now limited to special breeding requirements only.

No appreciable amount of eggs was imported.

EXPORTS

These consist mainly of day-old chicks, but also some table poultry; when local requirements are satisfied there will certainly be markets available in other African territories. The increase in day-old chicks exported was 32,000 in number, and the value £11,500.

The following tables give details of the imports and exports of poultry products for the Federation from August, 1958, to July, 1959, inclusive.

TABLE A

IMPORTS

Article and Country of Origin	Quantity	Value
Poultry, live:	No.	£
Union of South Africa	8,090	801
United Kingdom	1,460	346
Denmark	575	112
Tanganyika	8	10
TOTAL	10,133	1,269
Poultry, dressed:	lb.	
Union of South Africa	251,416	37,403
United Kingdom	5,479	1,207
Tanganyika	886	176
Bechuanaland	100	15
France	2	1
TOTAL	257,883	38,802
Eggs, in shell:	dozen	
Union of South Africa	2,293	369
Eggs, liquid or dried:	lb.	
Union of South Africa	11,794	1,032
United States of America	2,000	362
United Kingdom	748	281
Netherlands	72	22
TOTAL	14,614	1,697

TABLE B

EXPORTS

There were no re-exports during the year under review.

Article and Country of Destination	Domestic Produce	
	Quantity	Value
		£
Poultry, live:	No.	
Belgian Congo	67,619	19,055
Kenya	22,160	33,23
Moçambique	18,640	2,050
Tanganyika	3,050	342
Uganda	550	80
Bechuanaland	7	3
United Kingdom	2	1
TOTAL	112,028	24,854
Poultry, dressed:	lb.	
Belgian Congo	512	83
Eggs in shell:	dozen	
Moçambique	6,798	1,886
Belgian Congo	5	1
TOTAL	6,803	1,887
Eggs, liquid or dried:	—	—

NUMBERS OF POULTRY, POULTRY PRODUCTS, AND VALUE, IN 1958

		Southern Rhodesia	Northern Rhodesia
Fowls:			
Laying hens		305,500	128,100
Others		385,700	116,600
TOTAL: (935,900)		691,200	244,700
Ducks		28,200	7,200
Turkeys		23,000	5,200
Geese		5,200	1,000
Hen eggs sold	No. (dozen)	2,584,000	1,187,000
	Value £	£430,600	£225,700
Table birds sold	Weight (lb.)	1,152,000	306,400
	Value £	£188,500	£55,900
Day old chicks sold	No.	768,100	39,300
	Value £	£66,800	£3,400

GWEBI COLLEGE

Poultry Branch. The Thirty-ninth Annual Official Egg Laying Test concluded on January 30th, 1959. A full report was published in the March/April issue of the *Rhodesia Agricultural Journal.* Whilst the total egg production on a survival basis was slightly lower than last year it showed improvement on average. The hen housed average was higher than in 1958, reflecting the improved mortality rate, which was below average at 7 per cent.

Owing to the large number of birds disqualified for breed faults it has been decided to publish results in future in two sections, one as a Breeders' Test which will be for stock complying with standard requirements and a second on production records regardless of standard requirements but including mortality.

In addition the Commercial Test based on value of eggs produced showed a marked improvement over the 1958 Test.

The Fortieth Annual Test commenced on March 1st, 1959, and suffered an early setback when two teams were stolen at the end of the first week. One could not be replaced. Security precautions have been increased.

Educational. A lecture programme of 42 lectures on Poultry Husbandry was given to first year students and practical instruction throughout the year.

A Short Course was held from 10th-14th August, and attended by 26 farmers who were selected from over 50 applicants. The poultry course is popular as it entails concentrated instruction by lectures, films, demonstrations and practical instruction in general poultry husbandry by the staff of this Branch.

Stock. Pedigree breeding of the breeds kept continued with improved results. With increased accommodation available this season larger numbers of pullets have been hatched which should enable quicker improvement by progeny testing in production ability possible.

The building of additional laying accommodation for 600 birds is in process of being completed.

The stock on hand at 30th August, 1959, was as follows:

Young stock under six months	2,763
Selected breeding stock	607
Turkeys	38
Waterfowl	39

Total income from the section by sale of eggs to Hostel, Salisbury Hospital, table poultry, pedigree stock, and Egg Laying Test fees amounted to £2,273.

MATOPOS RESEARCH STATION

At this station emphasis is on the breeding and production costs of table birds, but, in addition, this year saw the start of a Commercial Laying Test sponsored by the Bulawayo and District Poultry Association but supervised by Government officials. This test of birds in cages has been successful to date and it is anticipated the birds per pen, which at present is six, will be doubled next year.

A new laying house to accommodate 500 birds is nearing completion.

Experimental Work. A comparison of floor versus cage reared chicks for table birds was started. Data collected to date indicates wire floor reared birds weigh more at ten weeks than floor reared birds. Floor reared birds suffer less from breast blisters and hock disorders than cage reared birds.

High energy feeds have been investigated. A fibre content in feeds of below three per cent. induced cannibalism. Feeds with four per cent. fibre gave good results.

Breeding. Selected inbreeding has improved body weights at 12 weeks and for pullets at first egg for the New Hampshire flock by 12.5 per cent. over the last two years. The cross White Australorp x White Rock for table bird production has given good growth response, desirable carcase shape, and pure white plumage, Further studies are proceeding.

SPECIALIST EXTENSION AND ADVISORY SERVICES

The work of the Branch on specialist advisory services is of major importance and is carried out by the Chief Poultry Officer for Mashonaland, the Poultry Officer, Matopos, for Matabeleland, and the Poultry Officer at Lusaka for Northern Rhodesia. The demand for advisory services embracing farm visits, interviews,

meetings, and correspondence is heavy and cannot be adequately handled by the present staff in addition to other duties.

The Poultry Officer in Northern Rhodesia was replaced by a more qualified officer in July and the services available there have improved. It is necessary for this officer to travel extensively and the provision of a Poultry Officer on the Copperbelt will shortly be required.

VETERINARY

Serious poultry disease has been confined to a few individual outbreaks which have been controlled. These include Newcastle disease in Northern Rhodesia, cholera, typhoid; coccidiosis in chickens is now under better control with improved hygiene and the use of preventive drugs. The incidence of C.R.D. is undoubtedly widespread and is the main disease feared by the broiler industry.

The testing of all breeding stock for B.W.D. and fowl typhoid continued as in the past.

SHOWS AND POULTRY CLUB WORK

The Salisbury and District Poultry Club started two committees during the year; one, to examine the commercial aspects of poultry keeping, which has met regularly and gathered a good deal of information but has not yet been able to put forward specific views. The second committee has established a Rhodesian Breeders' Association which has become independent of the parent club and envisages Federal representation, though at present membership is confined to Mashonaland. Fifteen breeders are members of the Association at present, whose object is to provide improved stock for purchasers. This Branch, together with officials of the Veterinary Department, is assisting the Association in inspection of farms and stock.

The Salisbury and District Poultry Club held a successful Young Bird Show in April and a major show in September.

The Bulawayo and District Poultry Association staged a show in August and, as previously noted, is sponsoring the Commercial Egg Laying Test run at Matopos Research Station.

These are the only poultry clubs functioning at present but shows are held by the Show Societies in other centres. At all these, Poultry Officers of the Branch officiated as judges.

At Salisbury and Bulawayo Shows poultry exhibits were featured in the Departmental Halls.

STAFF

The only change in staff has been the appointment of Mr. Peter Francis as Poultry Officer in Northern Rhodesia in place of Mr. R. Fotheringham.

The efficient services of all members of the Branch during the year are acknowledged.

BRANCH OF BOTANY, PLANT PATHOLOGY AND SEED TESTING

DR. G. R. BATES, *Chief Botanist and Plant Pathologist*

INTRODUCTION

No changes occurred in the structure or organization of the Branch and each of the three component sections continued to function on the lines of past years. The staff position of the Seed Section was strengthened by the appointment of a second professional officer as Crop Inspector and by another technical assistant for the seed testing laboratory. The Senior Botanist, Dr. H. Wild, returned in July, 1959, from his three-year secondment in London to the Flora Zambesiaca project.

It is pleasing to be able to report that additional accommodation is being provided for both the Botany and Seed Testing Sections. The Herbarium building is being extended by a new wing which should take care of the influx of specimens for the next few years although, if the existing rate of intake continues, it will not be long before even more space will be needed. New offices, seed stores and another testing laboratory are being added to the Seed Testing building. Whilst these should be just sufficient to meet present requirements, the astonishingly rapid developments in local seed production make it clear it will not be long before more accommodation and ancillary staff will be required if we are to satisfy the demands of this important new industry.

Accessions to the Herbarium were a record and, despite the volume of routine work, there was a substantial increase in the number of scientific papers published on botanical subjects. Attention was also paid to various important aspects of economic botany, especially those concerned with aquatic weeds and their control.

Widespread outbreaks of stem disease in maize crops involved adjustments to the plant pathology programme in order to investigate this special problem. Virus diseases of potatoes and maize received increased attention whilst long-term studies on wheat, fruit and vegetable diseases were continued.

Interest in the production of high quality seed crops gained momentum and demands by growers on the advisory, inspection and testing services of the seed section were, if anything, even heavier than in previous years. The rate of development of this comparatively new industry is such that it tends to regularly outstrip the capabilities of the laboratory, with a consequent build-up of a considerable backlog of samples awaiting testing. Strenuous efforts are being made to remedy this by the recruitment of more staff and the provision of increased laboratory and storage accommodation.

The work of all sections of the Branch owes much to the valued co-operation and assistance received from other Branches and Research Stations of this Ministry and also from the Department of Conservation and Extension.

The usual courses of lectures on plant pathology and seed testing were delivered to students at the Gwebi College of Agriculture. Numerous Farmers' Associations and other organizations concerned with agriculture and horticulture were addressed by officers of the Branch. Each section of the Branch contributed an exhibit to the Salisbury Agricultural Show; the Plant Pathology Section also provided a display and an advisory service at the annual Horticultural Trade Show in Salisbury.

One paper was published in the *Rhodesia Agricultural Journal*, and six in local and overseas scientific journals during the period under review. Details of these scientific publications are appended to the subsequent reports of each section of the Branch. Two papers were also submitted to the 1959 Annual Conference of Professional Officers. Articles, notes and reviews were contributed to local farming journals and to the daily Press.

BOTANY

Herbarium. The total intake of accessions was 10,175, an all-time record which brings the total number housed in the Herbarium to 98,845 specimens. No less than 3,142 plants were named for Government Departments and the proportion of these received from the two Northern Territories again increased slightly.

Particularly useful collections were contributed by Messrs. E. A. Robinson, L. D. E. F. Vesey-Fitzgerald, W. D. Holmes and D. B. Fanshawe, and Mrs. H. M. Richards from Northern Rhodesia; by Mr. J. S. de Beer from Bechuanaland and by Messrs. N. C. Chase, C. R. Savory, R. Goodier, J. Farrell, Major O. B.

Miller and Dr. O. West from various parts of Southern Rhodesia. In addition an excellent collection of grasses was provided by Mr. W. B. Cleghorn, whilst Mr. D. S. Mitchell and Mr. L. C. Leach supplied valuable material of ferns and succulents respectively. Our thanks are due to these indefatigable collectors and to the many others who have so kindly helped to build up our Herbarium. Collecting expeditions were made by the staff to the Binga, Beit Bridge and Tuli areas, which resulted in much interesting material.

Dr. N. B. K. Robson, a member of the London staff of the Flora Zambesiaca, spent six months in the Federation and collected extensively in the north-eastern district of Northern Rhodesia and in Central Nyasaland. His expedition succeeded in obtaining nearly 2,000 specimens from this hitherto botanically unexplored region.

More than 11,000 duplicates were distributed to herbaria in many parts of the world and some 5,100 received in exchange. Our more important exchanges were with Kew, the British Museum (Natural History), Pretoria, Yangambi, Brussels and Lourenço Marques.

Printing delays held up the publication of Volume I, Part 1, of the Flora Zambesiaca which is now expected to appear towards the end of the year or early in 1960. Part 2 of the same volume is ready for the press and should be published during 1960.

Considerable progress has also been made on several of the families to be included in Volume II and work has begun in the Salisbury Herbarium on the *Vitaceae* and *Simaroubaceae* for this volume.

At the request of the National Herbarium, Pretoria, Dr. H. Wild undertook, and has completed, the writing of the *Tiliaceae* for the new Flora of Southern Africa.

Due to lack of funds no development has been possible with the National Botanic Garden project, apart from routine maintenance. However, the Southern Rhodesia State Lottery trustees have most generously offered a sum of £6,000 towards the furthering of the project, provided the necessary additional funds to establish the Garden on a sound footing can be obtained from other sources.

Of the many visitors who came to work in the Herbarium during the year special mention must be made of Mr. F. C. Greatrex, who continued to name our orchid material.

Economic Botany. Many enquiries were received from farmers and agricultural officers regarding the identification and possible agronomic value of various indigenous and exotic legumes and grasses. Host plants of insects and nematodes were named for specialists in these fields.

An intensive programme of work on poisonous plants has been commenced in collaboration with the Veterinary Research laboratory. To date some 12 plants have been studied, of which the following definitely possess toxic properties to animals: *Urginea burkei, Chironia transvaalensis, Gnidia kraussiana,* and *Ranunculus multifidus. Epaltes alata* and *Eucomis undulata* were also identified in cases where they had proved poisonous to stock.

Further enquiries were received regarding the possible commercial exploitation of *Dioscorea sylvatica* but a survey of its distribution showed it is not present in sufficient quantity to justify organized collecting. Investigations on medicinal plants used in native herbal remedies were continued in collaboration with Dr. M. Gelfand.

An article describing weed control practices in the Federation was prepared for the Conservation Handbook being compiled by the Department of Conservation and Extension. The campaign against water hyacinth was actively pursued, special attention being directed to the Lake McIlwaine infestation where, as a result of the deliberate lowering of its level, a more intensive eradication programme has been practicable. A concentrated effort was also made to eliminate the water hyacinth infestations in the Odzi-Tsungwesi districts.

Another aquatic weed, *Salvinia auriculata,* is arousing some concern following its appearance in substantial colonies in Lake Kariba. The weed has been present in the upper Zambezi above the Victoria Falls for many years but has not hitherto shown any signs of excessive growth. Trials with a range of chemical weed-killers against this new pest have been planned.

Studies have also been undertaken on the occurrence, taxonomy and ecology of certain blue-green algae in Southern Rhodesia, mainly species of *Microcystis,* which elsewhere are associated with the tainting of drinking water supplies and, under special circumstances, of causing the death of animals and stock.

In co-operation with the Department of Conservation and Extension and commercial firms the botanical staff have planned further trials with herbicides

against *Lantana camara*. They have also participated in a new propaganda drive designed to enlighten the public on the increasing danger of this plant and to encourage its eradication by farmers and gardeners.

An unusual weed problem brought to our attention concerned the choking of the concrete lined intake to a Northern Rhodesia hydro-electric plant by a species of *Angolaea*, a rare member of the aquatic family *Podostemonaceae*.

Publications. (Note: For information and to ensure a complete record, the following list includes several papers published before 1958, but not previously notified in annual reports):

1. *A Revised Classification of the Genus Commiphora Jacq.*, H. Wild in Bol. Soc. Brot., *33*, 2 Sér., 1959.
2. *Botanical Notes Relating to the van Niekerk Ruins*, H. Wild—Chapter 9 of Summers' "Inyanga, Prehistoric Settlements in Southern Rhodesia", C.U.P., 1958.
3. *Some Native Herbal Remedies at Present in Use in Mashonaland*, H. Wild and M. Gelfand in Centr. Afr. J. Med., *5*, 6, June, 1959.
4. *Gladiolus laxiflorus*, H. Wild in Flowering Plants of Africa, t.1287, *XXX* (1), Jan., 1959.
5. *Flora Zambesiaca*, H. Wild in Mem. Soc. Brot *14*, Nov., 1958 (report to AETFAT Conference in September, 1958, Paris).
6. *New and Little-known species from the Flora Zambesiaca Area III*, H. Wild in Bol. Soc. Brot., *31*, 2 Sér., June, 1957.
7. *New and Little-known Species from the Flora Zambesiaca Area IV*, H. Wild in Bol. Soc. Brot., *32*, 2 Sér., June, 1958.
8. *New and Little-known Species from The Flora Zambesiaca Area VII*, H. Wild in Bol. Soc. Brot., *33*, 2 Sér., May, 1959.
9. *Some Investigations on The Vegetation of the North-Eastern Part of Makarikari Salt Pan, Bechuanaland*, S. C. Seagrief and R. B. Drummond in Proc. Trans. Rhod. Sci. Ass., *XLVI*, 1958
10. *Flora of the Matopos*, H. Wild in R. Tredgold (ed.) "The Matopos" pp. 89-92. Fed. Govt. Rhod. Nyas., 1956.
11. *A First Check-List of the Vascular Plants of the Chimanimani Mountains*, R. Goodier and J. B. Phipps in Proc. Trans. Rhod. Sci. Ass. (in preparation).

PLANT PATHOLOGY

ADVISORY

Field work and farm visits by plant pathologists had to be curtailed owing to the pressing demands on the transport vote of the Branch by the seed inspection and advisory services. Wherever practicable, joint trips were made, but this is not always satisfactory and the situation can only be remedied by increasing the allocation of funds for travelling. Despite these difficulties many areas of the country were visited, special attention being given to the Eastern Districts and to the principal maize, tobacco, fruit and vegetable growing districts.

The erratic distribution of rainfall made the 1958-59 summer season a difficult one for many crops, although with a few notable exceptions, diseases were not of serious consequence. The number of specimens received for examination rose to 674 and included 19 new host or disease records of which the following are of particular interest:

Leaf spot and die-back of bougainvillea due to *Phytophthora palmivora* (Butl.) Butler; bacterial leaf spot of cowpea due to *Xanthomonas vignicola* Burkholder; wilt of cotton due to *Verticillium dahliae* Kleb.; gummosis of sugar-cane due to *Xanthomonas vasculorum* (Cobb) Dowson, and white rust of radish due to *Cystopus candidus* (Pers.) de Bary.

Tobacco. Anthracnose *(Colletotrichum tabacum)* was troublesome in seed-beds where it appeared earlier than usual. As previously reported, angular spot also developed exceptionally early on Virginia type seedlings. The general disease pattern amongst the crop in the field was similar to that of the 1957-58 season although considerably less white mould was reported. The two bacterial diseases, wildfire and angular spot tended to show a steady build-up during the early part of the season, reaching a peak in January, after which their incidence rapidly declined. Rosette virus disease was more prevalent and showed up earlier than usual. This disease has assumed increasing importance in recent years and its

regular appearance suggests that present agronomic practices favour its perpetuation on a wider scale than in the past. A new distorting virus disease of tobacco was observed by research officers of the Tobacco Research Board. Preliminary investigations show it can be transmitted both mechanically and by the aphid *Myzus persicae*.

One case of bacterial (Granville) wilt was reported from the Lusaka district.

Potato. Less damage was caused by late blight than in any year since the disease first became established in Southern Rhodesia. It was reported in October, 1958, from the Melsetter district and developed for the first time on plantings of the second irrigation crop in the Salisbury area following a short rainy spell during late October-early November.

The races of *Phytophthora infestans* associated with this unseasonal outbreak were identified as 1, 4 and 1, 3, 4. Summer crop potatoes were not seriously affected by late blight and some growers obtained satisfactory yields from susceptible varieties. Race 4 was identified from late blight infected seed potatoes observed in a consignment from Scotland. This strain of the fungus was also found in earlier tests made on imported seed tubers from the same source five and six years ago. Blackleg *(Erwinia atroseptica)* was again prevalent in first irrigation crops grown from imported seed. The first definite case of blackleg to be found in a crop grown from locally produced seed was recorded, the seed concerned being produced in one of the highest parts of the Eastern Districts. Severe leaf roll developed in crops grown from Up-to-Date seed imported from South Africa. Bacterial wilt was recorded from several localities and was observed to be unusually prevalent on several farms in the Lusaka area. Other diseases observed, but in no case of major consequence, were common scab, silver scurf, and early blight *(Alternaria solani)*.

Maize. The most notable exception to the general disease picture was undoubtedly maize which not only showed more cob-rotting than for many seasons but was also considerably damaged by stalk-rots associated with the same group of fungal pathogens responsible for the cob-rots.

Diplodia zeae, *Fusarium graminearum* and possibly other *Fusarium* species were implicated in both cases. It has been difficult to pinpoint the precise reason or reasons for this sudden and widespread outbreak of such diseases. Seasonal weather conditions could be linked with the trouble and a build-up of the pathogens may have occurred with the increasing adoption of the trash farming system. Not only were losses caused due to heavy cob infection on some farms but considerable amounts of maize were down-graded where a light infection or discolouration following lodging occurred.

By contrast *Helminthosporium* leaf blight was of negligible importance whilst, for the second successive season, no tropical rust *(Puccinia polysora)* was seen or reported.

More cases of maize streak virus were recorded from crops in the principal maize-growing districts both in Southern and Northern Rhodesia. Moreover, circumstantial evidence, which we are presently attempting to check experimentally, indicates that wheat is also susceptible to one or more strains of the same virus. The problem is thus more complex and potentially dangerous than it at first appeared. Another factor of some practical importance has been the discovery of maize streak amongst volunteer plants growing in irrigated land which previously carried a summer crop of maize.

The characteristic zonate leaf markings resembling the "leopard spot" condition reported on maize from Kenya and elsewhere were far less common during the season under review.

Castor Bean. Interest in this crop has waned considerably and this was reflected in the sharp decline in the number of specimens received for examination. Observations on a replicated variety trial at the Salisbury Experiment Station showed that none of the 12 varieties included possessed any obvious resistance to Alternaria blight.

Sugar-Cane. Despite the extensive plantings made in recent years at Triangle and Chirundu no serious outbreaks of sugar-cane smut *(Ustilago scitaminea)* have occurred. The disease is, however, quite widely distributed throughout these estates with localized areas of fairly heavy infection amongst moderately susceptible varieties. Several recently introduced Barbados varieties have proved very susceptible to the disease. Brown spot *(Cercospora longipes)* became fairly general on the variety C.P.29/291. Gumming disease *(Xanthomonas vasculorum)* was discovered for the first time amongst plantings of N.Co.310 at the Triangle Estates.

Cotton. The first recorded instance of a *Verticillium* wilt of cotton in Southern Rhodesia was obtained during the year from a variety trial at the Henderson Research Station. Only one small plot was affected, the pathogen being identified as *V. dahliae.*

Groundnuts. Leaf spot due to *Cercospora arachidicola* was of negligible importance, whereas rosette virus was more generally prevalent than for many years past and was responsible for heavy losses throughout the Federation. Poor stands due to drought periods during planting time undoubtedly contributed to the widespread occurrence of rosette.

Forage and Green Manure Crops. Most legumes in this category escaped the ravages of diseases during the 1958-59 summer season and it is noteworthy that not a single report of stem-break in sunnhemp was received. Root and vine rot *(Phytophthora dreschleri)* of velvet bean occurred on farms in the Salisbury and Mazoe districts. Leaf spotting diseases and rust were again associated with defoliation of lucerne crops on several high-veld farms.

Vegetables. Black rot was, as usual, the most widely reported disease of Brassica crops, being particularly severe amongst early planted cauliflowers in the Eastern Districts.

Exceptionally high temperatures during the period April-June, 1959, were linked with widespread outbreaks of pea mildew on crops grown for canning and for seed. Leaf and stem blight due to *Ascochyta pisi* was also more prevalent than usual amongst irrigated pea crops, the stem blight phase being accentuated by flood irrigation.

Although late blight appeared early in January on outdoor tomato crops in the Salisbury district and rapidly became widespread throughout Mashonaland and the Eastern Districts it did not cause anything like the losses experienced in past years. A few cases of bacterial wilt and bacterial spot *(Xanthomonas vesicatoria)* were reported whilst leaf mould appeared in glasshouse crops and, for the first time, in outdoor plantings at much higher altitudes than previously noted.

Fruit. The increased interest in vines as a commercial proposition in the Federation has been reflected by the considerably greater number of enquiries and specimens received. Anthracnose and the powdery and downy mildews were most commonly recorded diseases of vines. Peach rust was found attacking peach fruits for the first time, causing small sunken lesions in which sporing developed. Another new manifestation of a well-known disease was recorded in the case of strawberries, where fruits were found with "black seed" symptoms following infection by the leaf spot fungus *Mycosphaerella fragariae.*

Flowers. No further cases of Kronmek *(Lycopersicum virus 3)* were detected in routine inspections made in terms of the Kromnek Regulations. Two serious diseases of Gladiolus caused heavy losses to growers; *Sclerotium (Stromatinia) gladioli* devastated plantings grown from corms imported from Holland whilst other consignments of corms from South Africa were severely infected by *Bacterium marginatum.*

Another interesting mycological record was the finding of the perithecial stage of *Erysiphe polygoni* on heavily mildewed larkspur plants.

RESEARCH

Maize. The survey of the incidence and distribution of maize streak virus was continued with the co-operation of Conservation Officers and of farmers through the medium of short illustrated articles in local journals. Evidence now accumulated confirms the widespread distribution of this potentially serious disease in the principal maize producing areas of both Southern and Northern Rhodesia. Although the incidence is still low, infected maize plants were discovered, either as volunteers or in irrigated crops, during most months of the year. The collaboration of the Entomology Branch has been obtained in searching for insect vectors of maize streak to undertake transmission experiments in the greenhouse. One of the heaviest outbreaks of the disease was discovered at the Henderson Research Station. Streak has also been noted on maize at the Salisbury Experiment Station and the same virus is also suspected of being responsible for a characteristic stunting, accompanied by heavy tillering and the development of chlorotic streaking of the leaves, in both summer and winter wheat crops at the same station. Certain varieties, notably Gabo and Kenya F93 were very severely affected. These stunt symptoms were also observed on winter wheat plantings at Henderson and Odzi, both areas having had records of streak in the preceding summer maize crops.

Work on the zonate leaf spot and freckling of maize referred to in last year's report was discontinued in view of the more urgent problems of streak virus and the cob and stalk rot complex associated with *Diplodia zeae* and species of *Fusarium*. New field trials have been planned at the Gatooma Research Station to investigate the latter problem which will replace the previous stubble mulch-cum-trashing trial, originally designed to study *Helminthosporium* leaf blight.

Wheat. Critical identification of the local races of wheat stem rust *(Puccinia graminis tritici)* was again handicapped by lack of suitable testing facilities, but a plant growth chamber is soon to be erected which should overcome this difficulty. Race 21 was dominant on the summer wheat crop at Salisbury, race 34 was also recognized on the same material. A similar distribution was found in rust collections from several irrigated winter crops, race 21 being widespread with race 34 also present on some crops. Further batches of wheat seed (Kenya F93) were irradiated with X-ray dosages of 27,500 v. in the hope of obtaining useful mutations for the breeding programme.

Potatoes. Investigations on the survival of the bacterial wilt organism *(Pseudomonas solanacearum)* in heavy soils were continued. Results obtained confirm those previously reported in that the disease can be readily perpetuated from one rainy season to the next by regular irrigations during the dry season. On the other hand, the disease could not be recovered (using potatoes as a test host) from inoculated plots left in dry fallow throughout the dry season.

Foundation stocks of potato varieties established in isolation at a selected site in the Eastern Districts were virus X, tested twice during the growing season, using antiserum. Arrangements have been made to conduct regular serological tests of this nature on all mother stocks maintained by the Department.

Legumes. Seed of indigenous *Mucuna* species was obtained from various parts of the Federation and tested alongside commercial velvet bean varieties for susceptibility to the root and vine rot caused by *Phytophthora dreschleri*. All the material tested proved very susceptible to the disease with the exception of a collection of *M. pruriens* from the Sabi Valley which, although not wholely resistant, exhibited sufficient resistance to justify its use in a breeding programme.

Field trials to assess the loss in yield of groundnuts from *Cercospora* leaf spot *(C. arachidicola)* and the possibility of controlling the disease by sulphur dust were inconclusive due to the very low incidence of natural infection.

Deciduous Fruit. The phytotoxicity of various copper fungicides to apples was studied at the Rhodes Inyanga Orchards. All spray formulations were adjusted to 0.1 per cent. copper content and applied at two different dates to four apple varieties. Rhode Island Greening and White Winter Pearmain proved most susceptible to injury, Versfeld and Red Delicious developing insignificant injury under the conditions of these trials. Fruit russetting was less severe after December than after October spray applications. Copper oxychloride and 2 : 6 : 50 Bordeaux mixture were appreciably less phytotoxic to the fruit and foliage than 2 : 3 · 50 Bordeaux or cuprous oxide.

Good control of bitter rot in commercial orchards situated in high rainfall areas was obtained using a spray schedule consisting of three applications of 0.15 per cent. maneb at three-week intervals from late October onwards, followed but four fortnightly spraying with ready-mixed Bordeaux mixture (8lb./100 gals.). No fruit injury was caused by this schedule whilst bitter rot infection was reduced from 19.1 per cent. in the controls to 2.1 per cent.

Citrus. The survey of citrus orchards and smaller garden plantings for the occurrence of citrus black spot due to *Guignardia citricarpa* was continued and intensified. No visible or "active" black spot has yet been found in the course of this country-wide survey which has, on the other hand, uncovered the presence of the causal fungus as a latent infection in citrus leaves in several old established plantings. Lemons and the Valencia late orange variety appear to be the most common hosts of the fungus.

Publications.

1. "Experiments in Controlling Diseases of Tomatoes in Southern Rhodesia", by J. O. Whiteside, R.A.J., 55, 533-545, 1958.
2. "Diseases of Legume Crops in Southern Rhodesia", by J. O. Whiteside, Ann. Conf. Prof. Officers, June, 1959.
3. "Potato Diseases", by G. W. Herd, contributed to forthcoming bulletin on potato growing.
4. Joint article by the Plant Pathology staff on Crop and Plant Diseases and their Control for inclusion in the "Conservation Handbook" now in preparation.

SEED TESTING

Interest in various types of seed production showed no signs of abating and the pressure of work on all members of the Seed Testing staff was maintained at a high level throughout the year. Tribute must again be paid to their conscientious efforts and really hard work in the face of an apparently never-ending influx of samples and enquiries. No less than 406 people visited the Laboratory for information and advice on seed production matters.

The Officer-in-Charge, Seed Services, was appointed Federal liaison officer to the forthcoming F.A.O. World Seed Year in 1961, and, as such, will be responsible for local contributions to the F.A.O. Seed Handbook and the organization of activities to be linked with the Seed Year project.

Another important development was the establishment of a National Seed Council which consists of the chairmen of all existing seed associations under the chairmanship of the President of the Rhodesia National Farmers' Union.

Laboratory. The number of samples received was 1,594, a reduction of 20 per cent. compared with the previous year. This decline was largely accounted for by the fewer grading samples sent in by the Grain Marketing Board. Forty-six of the total samples received were rejected by failing to satisfy the prescribed minimum standards and a further 41 samples of grass seed were rejected for certification because of excessive weed seed content. Numerous special tests for disease, identification, and the presence of dodder were also made. Eighty-two phytosanitary certificates were issued for export consignments of locally produced seed.

The incidence of the two important cob-rotting pathogens, *Diplodia zeae* and *Fusarium graminearum* on both certified hybrid and open-pollinated seed maize was appreciably higher than in the previous year, thus continuing a trend which has been apparent for the past two seasons. Similarly, the amount of certified hybrid seed infected by *Colletotrichum graminicolum* also rose for the third successive season. Grain infected by this organism often rotted completely in germination tests. Another fungus, *Diplodia macrospora,* was observed for the first time on seed maize from the Mazoe Valley and Northern Rhodesia, although it had previously been found causing a cob rot in the Eastern Districts. The proportion of insect damaged and chipped grain also increased in seed maize samples. These trends are viewed with concern and must be effectively countered if locally produced seed maize is to maintain its high reputation.

One hundred and sixty-six samples of maize and various small grains were examined for grading purposes on behalf of the Grain Marketing Board. Most of the maize samples were from consignments destined for export.

The quality of wheat seed received for testing was surprisingly low compared with previous years and showed an average of 45 per cent. infection with black point *(Helminthosporium sativum).*

Pea seed produced locally with overhead irrigation showed considerably more infection by *Ascochyta pisi,* than comparable seed from flood irrigated crops.

Seed Production. With few exceptions all field inspections of pasture grass, tobacco, vegetable and flower seed and potato crops registered under the certification schemes of the four associations concerned were conducted by officers of this Branch. The additional work involved in handling the inspections of tobacco seedbeds and crops for the production of certified seed proved greater than anticipated and strained the resources of the staff and their travelling vote to the utmost.

1. *Grasses.* Production of certified grass seed rose by some 35 per cent. to a total of 108,000 lb., made up of 62,200 lb. of Katambora Rhodes, 41,300 lb. of Giant Rhodes and 2,500 lb. of Sabi Panicum. The early cessation of the rains adversely affected production especially in the case of late planted crops. A new strain of *Panicum maximum* known as Sabi Panicum was released from the Grasslands Research Station and brought under certification for the first time. Experience has confirmed that under local conditions the Ermelo strain of Weeping Love grass will only yield satisfactorily when grown under irrigation. Some concern is felt by the increasing prevalence of a species of *Helminthosporium* amongst crops of Katambora Rhodes grass. The fungus causes serious damage to the foliage and, as it is known to be seed-borne, is of major importance in the production of certified seed. A second disease of Katambora, due to an unidentified species of rust, has also proved troublesome and will have to be carefully watched.

2. *Vegetable and Flower Seed.* Three well-known United Kingdom seed houses have now established themselves in the Federation and this has already greatly stimulated the production of certain types of vegetable seeds. One thousand, three hundred and seventy-eight acres of vegetable seed crops were inspected, 1,000

acres consisting of peas. The season proved a difficult one for peas, exceptionally high temperatures coupled with the lack of experience of some growers resulted in lower yields than anticipated. Nevertheless, yields of one ton per acre were not unusual.

Recent estimates put the total production of vegetable and flower seeds in the region of 750,000 lb. during 1959.

Trial plantings of several varieties of vegetables have demonstrated that some of them are unsuitable for seed production locally. It was observed that early varieties of peas are more sensitive to the effects of high temperature than late varieties. Difficulty was also experienced in seeding some varieties of onion.

3. *Potatoes.* One thousand and forty-two acres of seed potato crops were inspected for certification, 11 crops were rejected. Instances of mixed varieties were more frequent than in previous years. More than 41,000 pockets of 75 lb. weight were certified and included 14 different varieties.

4. *Tobacco.* Thanks to the efforts of the Executive Committee of the newly formed Rhodesia Tobacco Seed Growers' Association and of the professional staff of the Branch it was possible to initiate a certification scheme for tobacco seed during the 1958-59 season.

Every care was taken to ensure that only healthy, disease-free and true to type seed was produced and the vigorous nature of the inspections is demonstrated by the fact that no less than 45 per cent. of the crops registered under the scheme were rejected. The main cause of rejection was the presence of tobacco anthracnose. Much experience was gained during this first season as a result of which several amendments have been made to the certification standards and production procedures.

Taking everything into account, the total production of certified seed at 1,652 lb. reflects great credit on all concerned.

Investigations. The vigour and germinating ability of Virginia type tobacco seed treated with 0.25 per cent. silver nitrate instead of the standard 0.1 per cent. solution was not impaired when tested a year later. The persistence of tobacco anthracnose in the soil and the progress of infection up the plant in both the glass-house and field also received attention.

Further seed dressing trials were conducted in the field and in the laboratory. Black point *(Helminthosporium sativum)* of wheat was only partly controlled by organic mercury dressings. With groundnuts (Valencia) organic mercury dressings gave better results than in earlier trials, most of the treatments used giving significantly better emergence than the untreated controls. On the other hand none of the seed dressings tested on castor bean seed infected with *Alternaria ricini* provided any improvement in germination. Field experiments to compare the rate of emergence and stand of chipped and sound maize grain treated with a standard insecticide/fungicide preparation also failed to show any significant differences.

The regular inoculation trials designed to assess the reaction of maize hybrids and promising inbreds to infection by the common ear rotting pathogens were continued for the eighth successive season. Unfortunately, due to delays in planting and the early end of the main rains, results were inconclusive. It was established, however, that *Fusarium graminearum* can be successfully inoculated on to maize ears by dusting the silks with milled, infected grain.

The stubble mulch trial at Gatooma, now in its fourth season, again provided confirmation of previous findings in that cob infection by *Diplodia zeae* was substantially increased by stubble mulching but decreased with increasing levels of nitrogen. Where the trash was ploughed in, the incidence of Diplodia rot was significantly less than where it was left on the surface. Insect damage, including mould damage to the tips of the ears, and *Fusarium moniliforme* infection were increased by increasing levels of nitrogen but on stubble mulched plots the increase was considerably lower than on plots where all the trash was removed prior to ploughing or where the trash was ploughed in.

Publications

1. Cyclostyled advisory pamphlets on the production of many types of vegetable seed were prepared in conjunction with the Senior Horticulturist and widely circulated to growers.
2. "Testing, Handling and Production of Legume Seeds", by W. E. Kerr, being a paper read at the 1959 Professional Officers' Conference.
3. An article describing the functions and activities of the Seed Testing Section with special reference to seed production was prepared for the Conservation Handbook.

MISCELLANEOUS

The Branch was represented on many departmental and other committees including the technical committees attached to the four Seed Growers' Associations now established in Southern Rhodesia. In the course of the year, the total number of meetings attended by members of the staff was in excess of 100.

The Chief Botanist and Plant Pathologist was a member of the Federal delegation to the 14th Session of the Commission for Technical Co-operation in Africa held in Monrovia, Liberia, during February, 1959. He continued to be a Member of the Scientific Council for Africa (C.S.A.) and attended its tenth meeting held in Kampala, Uganda, in September, 1959. Yet another of his activities was that of Liaison Officer for the Commonwealth Agricultural Bureaux in the Federation.

Dr. J. O. Whiteside of the Plant Pathology Section spent two weeks in South Africa during August, 1959, studying the citrus research programme at the Subtropical Horticultural Research Station, Nelspruit.

AGRICULTURAL CHEMISTRY BRANCH

DR. H. WEINMANN, *Chief Agricultural Chemist*

GENERAL

The year 1958/59 was one of consolidation and steady progress for this Branch. It is particularly pleasing to note that the staff position appears to have stabilized itself at last. Since 1st March, 1959, all the professional and technical posts in the Branch have been occupied. Dr. Penelope Grant and Mr. R. J. Fenner joined the Branch as Agricultural Chemists, thus filling the last two remaining vacancies in this category. Messrs. S. Geissler and E. J. Gerritson were taken on as Technical Assistants, the former to fill a vacancy which had resulted from the only resignation which occurred during the year, the latter to occupy a newly created post.

It is probably partly due to the improved staff position that the output of work by the Branch markedly exceeded that of previous years. The total number of samples analysed and reported upon during the year amounted to 9,169, which is nearly 30 per cent. higher than the output for the preceding year (7,130). The number of samples analysed by the individual sections is given below, but it will be realized that such records are but an imperfect indication of the volume of work performed.

NUMBERS OF SAMPLES ANALYSED IN 1958/59

General Section	2,337
Soil Testing Section:	
Advisory	4,954
Investigatory	712
Research Section:*	
Pasture Research and Animal Nutrition	1,166
TOTAL	9,169

* (On account of the difficulty of expressing research work in terms of numbers of samples analysed, no such figure is given for work done in the Research Section other than for pasture research and animal nutrition.)

Detailed accounts of the activities of the individual Sections are given below but certain outstanding features deserve special mention.

The number of samples analysed during the year by the General Section showed an increase of 23 per cent. as compared with the previous year. One of the main functions of this section is the analysis of fertilizers, farm feeds and other farm requisites under the Fertilizers, Farm Feeds, Seeds and Remedies Act, 1952. While on account of pressure of other work the number of official samples of fertilizers and farm feeds analysed did not come up to last year's figure, it may be mentioned that at the request of the Veterinary Department also a number of commercial cattle dips (arsenical as well as organic preparations) were subjected to official checks.

A greatly increased number of agricultural liming materials submitted for analysis seems to be indicative of the interest in lime shown at the present time by the farming community. The Branch is fully aware of the importance of lime in Rhodesian agriculture, as indicated by the fact that the list of publications at the end of this report includes two articles on the use of lime. The existing fertilizer and farm feeds regulations do not adequately cover agricultural lime, and the Chief Agricultural Chemist and the Senior Officers of the Branch spent a considerable amount of time on the drafting of new regulations governing the registration and sale of agricultural liming materials.

Apart from analytical work done for private individuals, the General Section has analysed several hundred samples of plant materials, blood and bones for the various research stations, thus assisting them in important research work.

A spectacular increase in output was achieved by the Soil Testing Section, the total number of soil samples analysed and reported upon during 1958/59 exceeding those for the preceding year by 67 per cent. As in previous years, samples from tobacco lands formed the largest group, but those from maize lands (the second largest group) showed the biggest increase (122 per cent.) as compared with 1957/58. A new feature is a group of 434 advisory samples from Native Areas, submitted through the Southern Rhodesia Department of Native Agriculture. A fairly large number (791) of soil samples were also analysed for Northern Rhodesian farmers, including 298 samples submitted on behalf of the Credit Co-ordinating Committee (1958) and the Farmers' Debt Adjustment Board (1959).

The establishment of a new technical assistant's post in the Soil Testing Section during the past year greatly contributed to the increased efficiency of the Section by relieving the professional staff for the making of fertility assessments and the writing of reports. However, the staff position may have to be reviewed if the number of samples annually received for analysis should markedly increase in the future. It is also realized that in the assessment of fertility requirements (more particularly for tobacco) more attention should be paid to the examination of the subsoil than is possible at the present time and with the existing staff.

Though depleted in strength by the secondment of two experienced pedologists to the Department of Conservation and Extension, the Soil Survey Section has carried out a good deal of work. All the field work for the survey of the Southern Rhodesia area of the Zambezi Valley below Kariba has been completed, and the report should be available in the near future. In addition, a soil survey of various farms comprising the Matopos Research Station, as well as a number of other minor surveys and investigations were carried out by the Section.

With the staff position greatly improved, the Research Section has been able to do a considerable amount of interesting and useful investigatory work during the past year. A large number of samples analysed are reported under the heading "Pasture Research and Animal Nutrition". Pasture research and digestibility work at the Henderson and Matopos Research Stations has increased to such an extent that serious consideration should be given to the establishment of laboratories at these Stations where seconded Technical Assistants could do most of the routine analytical work required, as is already successfully done at the Grasslands Research Station.

Good progress has been made in the Spectrographic Laboratory with studies on the minor element status of Rhodesian soils, heavy metal toxicity in certain soils, mineral deficiencies in crops, etc. Other research work done during the year was concerned with investigations on the organic matter breakdown and moisture retention in Rhodesian soils, the effectiveness of ammoniated superphosphate, soil acidity, and slatiness and nutrient uptake of tobacco. Several scientific and popular papers have been published during the past year or are in the course of preparation.

As in previous years, the Chief Agricultural Chemist and the Senior Officers of the Branch have again been engaged on numerous outside activities, such as lectures, membership of committees, attendance at conferences, meetings and farmers' days, etc. The Chief Agricultural Chemist served on the Departmental Research Advisory Committee, the Agro-Economic Survey Committee, the Plant Introduction Committee and The Weed Control Committee.

The Chief Agricultural Chemist also served on the Animal Feeding Stuffs Committee of the Standards Association of Rhodesia and Nyasaland, which during the past year was concerned with the drafting of standards for cattle, pig and poultry feeds. He also acted as Chairman of a sub-committee charged with the drafting of analytical methods for the Standards Association. This sub-committee, on which also Mr. D. G. Bushnell served, successfully completed its task during the course of the year. Without in any way interfering with the government control of farm feeds, the activities of the Standards Association may be expected to result in a general improvement of the standards of stock feeds used in the country.

Lectures to farmers, farm planning and irrigation courses, and to students of Gwebi Agricultural College and the University College were given by the Chief Agricultural Chemist and Senior Officers of the Branch. Two scientific papers were presented at the Annual Professional Officers' Conference of the Department.

Mr. R. G. Thomas spent a considerable amount of time on editorial work for the Agricultural Survey Report (Agro-ecological and Agro-economic Survey) of Southern Rhodesia.

Dr. D. H. Saunder served on the Hydrology Co-ordinating Committee, on the Kafue Pilot Polder Advisory Committee, The Fertilizer Advisory Committee, The Drainage Advisory Committee and on the *Rhodesia Agricultural Journal* Editorial Committee, as well as on certain Departmental Committees. He also acted as correspondent for the Federation on the C.C.T.A. panel on the use of radio-isotopes in Agriculture, as rapporteur for Section III of the Third Inter-African Soils Conference held at Dalaba in November, 1959, and as the Federation's liaison officer for the same conference.

Dr. D. H. Saunder, Mr. R. G. Thomas and Mr. J. G. Thompson prepared scientific papers for the Third Inter-African Soil Conference held at Dalaba in November, 1959.

A meeting, at which soil and land classification problems were discussed with officers of the Department of Conservation and Extension and representatives of

the Northern Territories, was attended by Dr. H. Weinmann, Mr. R. G. Thomas and Mr. J. G. Thompson. The two last-named officers also attended a conference of pedologists at Pretoria called by S.A.R.C.C.U.S., and Dr. Saunder attended the joint C.C.T.A./F.A.O. conference on legumes at Bukavu in November, 1958, presenting a scientific paper.

The Branch has in the past year continued to co-operate as closely as possible with the research stations, other government departments, research organizations and institutions both within and outside the Federation. It is particularly pleasing to note that the Branch's relations with the Tobacco Research Board have perceptibly improved. Professional officers of the Branch and of the Board have met on various occasions during the year to discuss matters of common interest, and a technical popular article was published in a farming journal jointly by a Senior Officer of the Branch and a Senior Officer of the Board.

Thanks are due to all members of the staff for their co-operation and devotion to duty which have made possible the progress during the year.

A detailed account of the activities of the individual sections follows.

GENERAL SECTION

This year has seen a more stable state of conditions prevailing in this section; the vacancy created by the promotion of the Officer-in-Charge to Chief Agricultural Chemist was filled and, except for an exchange of officers, the staff position has remained constant.

It is pleasing to report that the total number of samples analysed rose to 2,337, an increase of 23 per cent. over the previous year's total of 1,904. This increase is not due to a greater number of samples of one particular type of material, but rather to general increases throughout the range of materials analysed by this laboratory.

Of the total number of samples, 1,335 were analysed at the request of various Federal and Territorial Government Departments.

Further, it is apparent that greater use is being made of the laboratory services by both Government departments and private individuals in Northern Rhodesia.

Apart from analytical work, this section has dispensed 139 Winchester quarts of standard dip testing iodine solution to the Veterinary Department and ten Winchester quarts of standardized sodium hydroxide solution for the Dairy Branch.

The section was also responsible for the collection of radio-active fall-out and its despatch to the United States Atomic Energy Commission.

A detailed breakdown of the samples analysed during the year 1958-59 is given in Table I.

The Control of Farm Requisites under the Fertilizers, Farm Feeds, Seeds and Remedies Act, 1952. The regular analytical checking of fertilizers, farm feeds and cattle dips is the concern of this section and in the past year, 26 fertilizers, 45 farm feeds and eight cattle dips (three arsenical and five organic) were sampled, analysed and reported upon. This number falls short of last year's total of 11 fertilizers and 104 farm feeds, as this work had to be sacrificed to the normal day to day analysis of routine samples. It is appreciated that a more complete check of these materials is desirable.

In general, the materials sampled came up to specifications, but in certain instances manufacturers were warned that their products were outside the analysis as required, and one manufacturer was convicted of certain contraventions under this Act.

TABLE I
SAMPLES ANALYSED IN THE GENERAL SECTION

Fertilizers, Manures and Limes:	
Fertilizers	30
Fertilizers (official samples)	26
Composts and kraal manures	18
Miscellaneous manures, etc.	13
Limes and limestones	55
Farm Feeds and Vegetable Products:	
Farm feeds	81
Farm feeds (Official samples)	45
Cereals	84
Legumes	60
Tobacco	60
Grasses and silages	17
Other vegetable products	153
Animal Products:	
Blood samples	602
Miscellaneous animal products	192
Oils	5
Waters	97

Toxicological Specimens:	
Analyses for arsenic—positive	345
Analyses for arsenic—negative	272
Other poisons	45
Protection Products:	
Arsenical dips	50
Organic dips	9
Miscellaneous	78
TOTAL	2,337

Fertilizers, Manures and Liming Materials (other than official samples). Apart from liming materials, the volume of work under this head continued at approximately the same level as in the previous year.

Great interest has been shown during the year in agricultural liming materials and a total of 55 samples were analysed as opposed to eight in 1957-58. As a result of the increase in volume of this work the scheme of analysis for this class of material has been completely revised to give rapid routine—but still accurate—laboratory methods.

Farm Feeds and Vegetable Products (other than official samples). The number of farm feeds analysed has risen from 65 in 1957-58 to 81 during this year, with a further 27 samples analysed for the Research Section. The total number of vegetable products has risen from 294 to 434, of which 267 were samples submitted by Government research establishments from current experimental work. The principal components of this group were 81 potato samples from the Salisbury Agricultural Experiment Station and 27 potato samples from Henderson Research Station analysed for moisture content; 49 soya bean hay samples from Gwebi Agricultural College, 31 wheat samples from Salisbury Agricultural Experiment Station for protein; 30 cotton samples from Sabi Valley Experiment Station for nitrogen, and 49 tobacco samples from the Research Section of this Branch for chlorine determinations.

Animal Products. The major portion of the total of 794 samples in this group was 602 blood samples; this compares with 642 blood samples in 1957-58. Of this number of blood samples, 491 were submitted by the Matopos Research Station for inorganic phosphorus determinations in connection with a mineral feeding supplement programme. This group also contains 180 bones from Henderson Research Station for total ash content, being part of a mineral feeding experiment.

Waters. The number of water samples analysed has risen from 34 to 97 in this year, the majority being analysed in connection with small irrigation schemes or as a result of Tobacco Research Board recommendations as to the chlorine factor.

Once again, as a result of the increase in this form of analysis, the laboratory methods have been completely revised to give rapid routine, yet accurate, laboratory procedures.

Toxicological Specimens. The number of toxicological specimens has increased this year from 610 for 1957-58 to 662. The bulk of the samples were tested for arsenic and 345 samples gave a positive result.

Cattle Dips. Mainly as a result of widespread oxidation of arsenical dip washes, the number of samples has risen from 19 to 50.

Where groups of materials have not been detailed above, then there was no outstanding information worthy of reporting.

SOIL TESTING SECTION

For some years there has been a steady annual increase in the number of soil samples submitted to the Branch for fertility assessment and fertilizer recommendations but, in the year under review, the increase has been dramatic. Table II demonstrates this.

TABLE II
SOIL SAMPLES RECEIVED : COMPARATIVE FIGURES FOR 3 YEARS

Nature of Samples	1956/57	1957/58		1958/59	
	Samples received	Samples received	Increase on previous year	Samples received	Increase on previous year
Advisory	2,793	3,223	15%	4,567	42%
Special Advisory:					
Native Areas	—	—	—	477	—
Total Advisory	2,793	3,223	15%	5,044	57%
Investigatory	302	531	76%	632	19%
Total of Advisory and Investigatory	3,095	3,754	21%	5,676	51%

The 477 samples listed separately under "Special Advisory" were submitted by the Department of Native Agriculture and Lands as part of a newly-initiated, long-term programme to encourage the economic use of fertilizers in Native Areas.

Reports were issued on 5,666 samples, of which 4,520 were advisory, 434 were special advisory for Native Areas, and 712 were to provide data for investigatory and research work—mainly of the Research Stations of the Department of Research and Specialist Services. Table III summarizes the completed work of the section by classifying samples upon which reports were issued in terms of (a) the crops for which fertilizer recommendations were required or the purpose that the report served, and (b) the territory from which the samples came. Table IV presents the salient features of the data for normal advisory work, and compares them with similar data for the previous year.

The increase in samples from Northern Rhodesia is not as significant as it might appear to be. Of the 791 soils reported on, 298 were submitted on behalf of the Credit Co-ordinating Committee (1958) and the Farmers' Debt Adjustment Board (1959) for free analysis, by special arrangement between the Department of Conservation and Extension and this Branch.

TABLE III

SOIL SAMPLES UPON WHICH REPORTS HAVE BEEN ISSUED

	Southern Rhodesia	Northern Rhodesia	Nyasaland	Foreign	Total
Advisory:—					
Tobacco: Flue-cured	1,685	99	9	9	1,802
Burley & Cigar Wrapper	2	2	—	—	4
Turkish	22	3	1	—	26
Seed-beds	56	2	—	—	58
Maize	858	541	—	6	1,405
Potatoes	76	35	—	—	111
Other Field Crops	130	40	—	5	175
Pastures and Lucerne	72	22	—	—	94
Market Garden Crops	91	9	1	2	103
Fruit Trees, Vines, etc.	53	5	—	47	105
Sugar-cane	2	—	—	—	2
Tea and Coffee	11	—	—	—	11
Conservation and Extension Demonstrations	22	14	—	—	36
Private Gardens	169	3	—	—	172
Sports Clubs	48	3	—	—	51
Miscellaneous Tests	172	6	—	7	185
Diagnosis & Fertility Assessment	173	7	—	—	180
Totals	3,642	791	11	76	4,520
Special Advisory:—					
Native Rotations	434	—	—	—	434
Investigatory:—					
Chemistry: Research	81	—	—	—	81
Research Stations	415	—	—	—	415
Conservation & Extension: Trials	80	34	—	—	114
Other Departments & Commissions	84	—	7	—	91
Foreign Research Organizations	—	—	—	11	11
Totals	660	34	7	11	712
GRAND TOTALS	4,736	825	18	87	5,666

TABLE IV

ADVISORY SOIL SAMPLES REPORTED : COMPARATIVE DATA

A. Nature of work B. Country of origin	1957/8		1958/9		Increase in 1958/9	
	Samples reported	% age of total	Samples reported	% age of total	Samples reported	% age of previous year
A.						
Flue-cured Tobacco	1,347	51%	1,802	40%	455	34%
Maize	632	24%	1,405	31%	773	122%
Other Crops	370	14%	689	15%	319	86%
Miscellaneous*	298	11%	624	14%	326	109%
TOTAL	2,647		4,520		1,873	71%
B.						
Southern Rhodesia	2,314	87·4%	3,642	80·6%		
Northern Rhodesia	324	12·2%	791	17·5%		
Nyasaland	5	0·2%	11	0·2%		
Foreign Countries	4	0·2%	76	1·7%		
TOTAL	2,647		4,520			

* "Miscellaneous" includes: Gardens, Sports Clubs, Conservation and Extension demonstrations, etc., and analyses for diagnostic purposes and for liming rates, etc.

Table IV shows clearly that by far the biggest increase has been in samples for maize recommendations. Flue-cured tobacco comes next in order of increase in numbers, but the proportional increase is the lowest of all. For a long time tobacco has regularly accounted for more than half the advisory work of the section, presumably because the crop gives high returns from small acreages and a correct balance of plant nutrients is so vitally important. The fact that the rates of tobacco samples to maize samples has narrowed considerably, and that the number of the latter has more than doubled in one year, suggests that farmers generally are becoming increasingly conscious of the economic importance of soundly-based fertilizer practice.

The section has functioned efficiently throughout the year and has consistently maintained the highest possible output. Most opportunely an additional Technical Assistant's post was established with effect from 1st July, 1959, and was fortunately filled immediately. This brought into correct balance the analytical and advisory aspects of the work by freeing a professional officer from routine analytical work for the making of fertility assessments and the writing of reports. Nevertheless, for about two and a half months, soil samples were received at a rate exceeding the capacity of the section, and the development of a temporary backlog was therefore unavoidable.

Although the section is now an efficiently balanced unit, experience in the year under review has shown that any further increase in the number of samples submitted, or a less advantageous distribution of them as a result of late rains delaying sampling, would inevitably lead to a heavy accumulation of samples which it might not be possible to dispose of in time for reports to be of any practical use to farmers.

It is also apparent that it would be extremely risky to expand the range of routine work done on samples. This is disturbing, because it is now obvious that assessments of the requirements of tobacco should be based on an examination of the subsoil as well as analysis of the topsoil. A determination of the texture of the subsoil is required in many cases for a sound interpretation of the nitrogen status, and a knowledge of the subsoil pH is desirable for an assessment of the liming rates. At the moment comparatively few subsoil samples are submitted, although the number is increasing. If the practice were actively encouraged through the normal channels of publicity, as it should be, an enormous increase in samples for partial analysis could be expected. This would involve complete reorganization of laboratory schedules, unless an additional analyst could be obtained, and it would be impossible to maintain the present output which, as already mentioned, is barely adequate at the moment and likely to be inadequate in the near future.

SOIL SURVEY SECTION

In this section the past year has been unprecedented in that in addition to the major surveys undertaken, the variety and number of short duration commitments have, in sum, taken up almost as much time as the major surveys themselves. Due to severe staff depletion caused mainly by secondments and transfers in previous years, the remaining soil survey staff had not completed a full two years' training period at the commencement of this year's field season. Consequently, practically all commitments other than the major surveys devolved upon the Senior Officer, and this in turn, severely limited the amount of time that could be devoted to instructional and supervisory visits to field parties in the major survey areas. Nevertheless, due in a large measure to the responsible and logical manner in which junior officers set about their work, these surveys have been very satisfactorily carried out, in spite of the minimum of supervision.

Field Work. The main survey carried out was that in the Zambezi Valley, from the Nyakasanga River eastwards to the Chewore River, during the period April to July. The purpose of this survey is to make an approximate assessment of the irrigable potential of the land below Kariba. Originally, it seemed doubtful whether the survey could be carried as far as the Chewore River by the end of the field season, particularly as in the early stages, the national emergency deprived this section of its Land Rovers. But, mainly because huge tracts of country could, with a minimum of work, be dismissed as unsuitable for irrigation, the survey was completed much earlier than originally expected.

While there are a few large blocks of irrigable soils, these are confined practically entirely to the country adjacent to the escarpment, and they are thus situated at very considerable distances from the river. In the overall picture the proportion of irrigable soils is disappointingly small.

The only other survey of any magnitude was that carried out on various farms comprising the *Matopos Research Station.* The detail in which survey work was

done on the various sections comprising this station varied according to the land use being applied; that is, a distinction was made between arable and non-arable areas. On the farm Westacre, the survey of arable areas was done in considerable detail but, the amount of information that could actually be mapped was limited by the scale of the only air photographs that were available for this part (1 : 20,000).

Other minor surveys and investigations included the following:—

Diti Crown Land Area. Brief reconnaissance, for irrigable potential of a 50-mile strip bordering the Limpopo River, eastwards from the Umzingwane-Limpopo confluence.

Copperbelt Soils Investigation, Northern Rhodesia. Brief examination of typical soils of the Copperbelt, primarily in connection with low base status and consequent infertility, in relation to Land Capability Classification.

Marandellas Sewage Disposal Experiments. Examination of soils and their drainage and permeability characteristics, at the site of this project.

Lone Star Ranch (Chiredzi Area), Faversham Estates (Zaka), and sections of Nuanetsi Ranch. Examination of numerous small areas for suitability for irrigation in connection with applications for water-rights.

Chisamba area, Northern Rhodesia. Visit with the seconded pedologist, to black heavy clay soils of this area, in connection with Land Capability Classification.

Triangle Sugar Estates. Visit with the Soil Physicist from the Sabi Valley Experiment Station, to design length-of-run experiments to be conducted in irrigating sugar-cane.

Mzarabani Reserve, Zambezi Valley. Minor survey to assess suitability of certain areas for native settlement.

Chibero Agricultural College. Visit to obtain broad assessment of soils on the three subsections concerned in this project.

Laboratory Work. During the year a total of 116 soil samples were analysed. Of these, 92 were taken in the previous field season's survey in the Zambezi Valley (between Kariba and the Nyakasanga River). The remaining samples pertained to some of the other minor surveys and investigations listed above, notably those in connection with the Copperbelt survey.

Laboratory work is confined practically entirely to the summer months, and for the first time it was possible this year to make a start on clay mineralogy investigation by means of differential thermal analysis. Owing to the short time available for this sort of work, limited, but nevertheless very valuable information was obtained. It is to be hoped that more time will become available for work of this fundamental nature in the future.

During the summer months all Soil Survey standard methods of analysis were revised and rewritten by the Senior Officer. The revised methods incorporated some of the more practical techniques studied in the United States of America in 1957. As and when time permits, further techniques, notably those connected with permeability measurements, will be incorporated.

RESEARCH SECTION

Pasture Research and Animal Nutrition. The number of samples analysed for research stations was much the same as last year. However, owing both to the very large number of samples submitted during the year and to the larger proportion of samples submitted for a complete feedstuff analysis including fibre determinations, a considerable number of samples had not been analysed by the end of the year.

In the coming year it will be necessary to considerably reduce the number of samples which can be accepted from research stations for fibre determination, this being the main limiting factor in controlling the output of the laboratory.

In the field of pasture and animal husbandry research enough analytical work of a routine nature is now required by each of the major research stations to justify the establishment of a chemical laboratory, staffed by a technical assistant, on the stations themselves. Such a laboratory has been in operation at the Grasslands Research Station for the whole of the year under review and has been an unqualified success. It is hoped that it will soon be possible to establish similar laboratories at both the Matopos and Henderson Research Stations.

There has been increasing emphasis on digestibility work, particularly at the Henderson Research Station where a technique testing experiment, investigating

the time of sampling and number of faeces samples necessary to give reproducible results, is being studied.

In order to handle the large number of chromic oxide determinations required, the possibility of modifying the analytical procedure was investigated and it was found that the titrimetric estimation of chromate could be replaced by a colorimetric estimation, involving measurement of absorption in the near ultra violet, using filtered radiation from a mercury vapour lamp. The adoption of this procedure has considerably shortened the time required for this analysis.

An experiment comparing the seasonal variation in quality of sweet and sour-veld grasses has been conducted by the Matopos Research Station and the Tuli Pasture Substation. The analytical results for protein and fibre do not, however, account for the observed differences in feeding value of the two grass types. Further work along the lines of mineral composition is therefore necessary on this problem.

Lysimeter leachates have again been analysed for the Grasslands Research Station. Leachates from plots under maize and velvet beans contained appreciably more nitrogen, potash and calcium than did those under grass.

A considerable amount of time has been spent in the determination of copper and cobalt in liver samples, particularly in connection with an investigation of the mineral nutrition of beef steers being conducted at the Henderson Research Station. As this trial is not yet completed, no conclusions can be drawn at this stage.

The number of samples analysed during the year was as follows:—

Pasture samples	539
Digestibility trials	501
Lysimeter leachates	62
Liver samples	36
Silages	13
Aphosphorosis investigations	15
TOTAL	1,166

Correlation of Crop Responses with Soil Analytical Data. Analysis of a considerable number of soil samples from field trials conducted by the Department and by the Extension Services have been carried out as usual by the Soil Testing Section.

The field results of most of these trials are now, or soon will be, available but it has not yet been possible for the Research Section to examine them in detail and to correlate them with the analytical data. As results from two cropping seasons are now available since the criteria for assessment of fertilizer requirements were last revised, their examination and, where indicated, a critical reappraisal of the interpretive criteria, will be a major exercise for the future.

Of particular interest was the establishment in Nyasaland of a number of maize trials designed to compare crop responses with soil analytical data, with special reference to testing criteria for the prediction of nitrogen responses. These trials which are to be continued next season should prove extremely useful in obtaining data under a wider variety of climatic conditions than have been studied in Southern Rhodesia.

Soil Organic Matter Studies. The "soil respirometers", the construction of which was reported last year, were used to obtain preliminary information on the "biological activity" (as measured by the rate of release of carbon dioxide on incubation) of a number of different soils. Wide differences were found between different soil types and also between soils of the same soil type under different management systems. It is apparent that, for a full appraisal of the soil and of the effect of different cultural or rotational practices applied to it, studies on the rate of mineralization of carbon may provide useful information, additional, as well as complementary, to that provided by studying mineralization of nitrogen.

For instance, although studies on the rate of mineralization of nitrogen would appear to provide the best means of assessing the immediate nitrogen status of soils they may not always—particularly when bulk organic matter is present and micro-biological immobilization of nitrogen is active—be validly applied to predicting future rates of soil organic matter mineralization, which would be more reliably assessed by studies on the mineralization of carbon.

A paper summarizing our experience in the use of laboratory incubation studies to determine rates of mineralization of nitrogn and carbon in Rhodesian soils was prepared, and will be presented at the forthcoming Third Inter-African Soils Conference.

Green Manuring. During the year the results of green manuring experiments, in particular that conducted on the Salisbury Experiment Station since 1952, were critically examined in an attempt to determine more precisely the reasons for the benefit of green manuring in Southern Rhodesia.

The conclusions reached were presented in two papers at scientific conferences concerned with legumes in agriculture.

Soil Moisture Relationships. Data obtained by means of the pressure-membrane and porous-plate equipment on the moisture retention of typical Rhodesian soils were published.

Comparison of Phosphate Fertilizers. In order to compare the phosphate supplying power of ammoniated superphosphate with that of single superphosphate, a pot trial was carried out using three soils low in alkali-extractable phosphate and of varying clay contents. Phosphate at three levels and lime at two levels was applied and the pots cropped to millet and lucerne. Results in most cases showed a greater increase in yield and phosphate uptake in the case of single superphosphate than in the case of ammoniated superphosphate. This difference was accentuated when there was an application of lime. It is interesting to note that, whereas with lucerne the effect of lime was decidedly beneficial, there was a marked decrease in yield and phosphate uptake of millet when lime was applied on the medium textured and heavy soils.

Mineral Nutrition. Preliminary studies of the minor element status of Rhodesian soils were continued.

Analysis of the series of veld grass samples collected in 1953 has been completed except for the cobalt determinations. The zinc and manganese contents were found to be unrelated to soil type, though relatively low manganese contents were found on some neutral soils and on some highly leached soils in the Eastern districts.

The copper content of the grasses tended to be lower on granite sands and Kalahari sands than on the red soils, whereas molybdenum was lowest on the red soils and highest on the granite sands. In contrast to this, the molybdenum extractable by the standard chemical procedure was high for the red soils and low for the granite sands, and it appears that new extraction procedures or new criteria will have to be established for advisory purposes.

The maize and lucerne samples collected in 1959 have been analysed except for cobalt, zinc and molybdenum.

There still remain a number of determinations of extractable soil minerals to be made by different procedures before the correlation of plant and soil contents can be attempted.

In addition to this general survey investigations were carried out on a number of particular problems of minor element deficiencies or toxicities.

Heavy Metal Toxicities. Heavy metal toxicities continue to be found particularly in the vicinity of the Great Dyke, but nickel toxicity has also been found near Lusaka and near Penhalonga.

During the year the results of recent research work on nickel and chromium toxicities were compiled and presented for publication in a paper which is now in the press.

Infertility of Acid Soils. Many instances of infertility of soils have been found to be associated with high aluminium or manganese concentrations in plants and with acid soil conditions. Attempts are therefore being made to encourage the correct use of lime in Rhodesian agriculture and two articles on this subject were published during the year.

Work on the causes of infertility of acid sandveld soils was started recently with the chemical analysis of samples from plots at the Grasslands Research Station. Preliminary results from determinations of pH and exchangeable and readily soluble aluminium indicate that the growth of lucerne is affected more by the concentration of soluble aluminium than by the pH of the soil. The release of soluble aluminium is related to the pH and organic matter status of the soil. It has been found that applications of up to five tons/acre of lime three seasons ago have had little effect on the acidity of the subsoil, but the penetration of lime may be increased by nitrogenous fertilizers. This line of study is being actively pursued as a major project.

Miscellaneous Deficiencies. The result of analyses carried out during the year indicated the occurrence of the following deficiencies:—

Molybdenum deficiency in both lucerne and citrus in the Mazoe Valley;

Magnesium deficiency in citrus on sandveld and in wattle in the Eastern districts;

Boron deficiency in lucerne in several areas;

Zinc deficiency in maize near Lusaka.

Slatey Tobacco. A number of samples of "slatey" tobacco have been analysed during the year. There was a tendency for a low K/Mg ratio in the affected leaves, but in the majority of cases a distinct correlation was found between the degree of "slate" and the aluminium content of the leaf produced on any one particular soil type, although the aluminium content was found to vary widely between different soil types. This suggests that, whilst aluminium itself is not a toxic factor, conditions which lead to a high aluminium uptake by the plant may be a contributory cause of this particular type of "off-type" tobacco. In view of the direct relationship between aluminium uptake by plants and soil pH, and also in view of the number of farmers reporting a high incidence of "slatey" tobacco on acid soils, it is felt that the soil acidity may have been a contributory cause, in addition to such other factors as moisture stress and associated increased chlorine uptake.

Although the samples received were somewhat high in chlorine content (a few very much so) there was little correlation between the incidence of "slate" and the chlorine content. It is suggested therefore that the "slatey" tobacco encountered in this work may be of slightly different origin to the soggy, rank smelling tobacco which has been found by the Tobacco Research Board to be closely associated with an increased chlorine uptake.

Further research on this problem is required.

Nutrient Uptake of Tobacco. Further analytical work on samples of leaves, tops, suckers and stalks collected during the 1955/56, 1956/57 and 1957/58 seasons was carried out, including determinations of chlorine, sulphur and certain trace elements apart from the more common nutrients. In addition, a further series of tests on the dry matter loss of tobacco leaves on curing was carried out in connection with this work.

The results of this work are now being evaluated and will, it is hoped, be presented in the form of a scientific paper during the course of the coming year.

General. A considerable amount of time was spent in the improvement of spectrographic procedures and in the preparation of working curves for materials of varying composition.

In addition to the research work described above, a number of analyses were carried out for the Bilharzia Research Laboratory and for the C.I.D.

PUBLICATIONS

1. McDonald, I., and Saunder, D. H., The Use of Lime. *The Rhodesian Farmer*, vol. 30, No. 20, 11th September, 1959. p.24.
2. Saunder, D. H., Some notes on the value of leguminous green manuring in Southern Rhodesia. Paper presented to joint C.C.T.A./F.A.O. meeting on legumes. Bukavu, November, 1958.
3. Saunder, D. H., Use of lime to maintain soil fertility. *Rhodesia Agricultural Journal*, 56, 47-49, 1959.
4. Saunder, D. H., Enlightened manuring of maize ensures a high standard. *Rhod. Herald*, Agricultural Show Supplement, 9th September, 1959.
5. Tillett, E. R., and Saunder, D. H., Soil moisture relationships of some Rhodesian soils. *Rhodesia Agricultural Journal, 56*, 61-64, 1959.

BRANCH OF ENTOMOLOGY

D. J. W. ROSE, *Acting Officer-in-Charge.*

INTRODUCTION

There were several staff changes and transfers during the year. The Senior Entomologist, Dr. C. E. Taylor, resigned to take an appointment with the Scottish Horticultural Research Institute. Mr. D. Rose, who had been on loan to the Grain Marketing Board and responsible for pest control investigations there, was recalled on promotion to the vacancy. Mr. P. Hewitt, who joined the Branch on contract terms in February, was attached to the Grain Marketing Board to continue the entomological investigations. Research upon the grain pest control problems was strengthened by the secondment of Mr. J. Pearson from the Pest Infestation Laboratory, D.S.I.R., Slough, England, to the Grain Marketing Board for a two-year period. Mr. A. Carnegie was transferred initially to Rhodes Inyanga Orchards and then to Umtail to serve the Eastern Districts and study pests of fruit.

The Chief Entomologist represented the Federation and the International Red Locust Control Service at the O.I.C.M.A. (African Migratory Locust Control Organization) Council meeting held in London during June. In his absence overseas, the Director of Research and Specialist Services attended the Council meeting of the International Red Locust Control Service held in Lourenço Marques during July.

Following the resignation of Dr. D. C. Gunn, C.B.E., from the post of Director, International Red Locust Control Services, Mr. C. du Plessis has been appointed as Director. The Chief Entomologist, Mr. J. A. Whellan, is to succeed Mr. C. du Plessis as President of the Council.

In June, the Chief Entomologist left for a study tour in the United States of America with the aid of a grant from the International Co-operation Administration. The measures being taken to control pests of stored grain, in particular Khapra beetle, are being investigated.

OUTBREAK OF PINK BOLLWORM *(Platyedra Gossypiella)* IN THE SABI VALLEY

An outbreak of pink bollworm was discovered infesting cotton grown in the Sabi Valley. This insect, an important pest of cotton in many parts of the world, had not previously been found in Southern Rhodesia. It seems probable that the infestation spread from cotton growing areas in Mocambique. Phytosanitary measures were introduced defining infested and quarantine areas, enforcing a closed cotton growing season, and requiring fumigation of all seed cotton before removal from the quarantine areas. The co-operation of cotton growers was obtained in the area with destruction of alternative host plants. Biological investigations have been undertaken with the co-operation of the Cotton Pest Research Scheme, Gatooma. These have been directed towards determining whether pink bollworm larvae will enter diapause and whether they are able to survive in the absence of cotton plants on alternative host plants. Results indicate that a diapause stage is not formed but that pink bollworm will be able to carry over from one cotton growing season to the next on *Hibiscus dongolensis*. *H. dongolensis* is restricted to lowveld areas.

Investigations are continuing and it is considered that closer attention will have to be given to elimination of alternative host plants during the dry season. In this respect a more detailed knowledge of the distribution and habits of the plants is required so that a more systematic and selective programme to destroy the alternate host plants can be undertaken. This aspect assumes even greater importance, if as seems likely, it becomes necessary to learn to grow cotton in the area in the continual presence of pink bollworm.

PESTS OF STORED GRAIN

Co-operation with the Grain Marketing Board in the study and control of stored products insects has continued. It was necessary to recall Mr. D. Rose from his duties with the Grain Marketing Board in June and supervision of the pest control measures was taken over by an administrative officer in the Board's employ. Mr. P. Hewitt, of this branch, is continuing the entomological investigations. Mr. J. Pearson was seconded from the Pest Infestation Laboratory, Slough, England, to the Board for special study of fumigation problems for two years. Satisfactory progress has been made and this is reflected in reductions of grain losses during storage and an improvement in the quality of grain for export. The Khapra beetle,

Trogoderma granarium, which was the cause of serious losses in the past, has been brought under control by the measures now practiced and to the extent that it is now rarely found in central grain stores. A better understanding of the problems connected with fumigation of bulk grain in silos in Southern Rhodesia and Northern Rhodesia has been obtained. Difficulties remaining are largely due to material or structural faults. Further experience with Phostoxin fumigation has confirmed that this fumigant is very satisfactory for use with bulk grain when methyl bromide cannot be used in silos.

Outbreaks of two species of moth, *Ephestia cautella* and *Plodia interpunctella* were serious in many grain stores in Southern and Northern Rhodesia. Although these caused relatively little weight loss to stored grain, webbing produced by the caterpillars covers sacks and joins grains making cleaning difficult. Investigations are continuing with the evaluation of different insecticides and formulations for control of stored products pests under our conditions.

BEAN STEM MAGGOT *(Agromyza phaseoli Coq.)*

As investigations carried out in East Africa had indicated that good control of bean stem maggot could be obtained with insecticidal seed dressing, trials were carried out at Salisbury to determine whether similar control could be obtained under local conditions. Good control was obtained by using 0.2 per cent. actual insecticide by weight to seed with Endrin, Dieldrin or Aldrin admixed as emulsion. DDT, Malathion, Chlorthion and Rogor were not effective. Results have been prepared for publication in the *Rhodesian Agricultural Journal*. (Dr. Taylor.)

CONTROL OF WHITE GRUBS *(Eulepida mashona Arrow)* IN PASTURES

Trials were completed at Grasslands Research Station in which various insecticides were compared for pretreatment of lands for control of white grub. The plots were sown to a ley pasture with Katambora Rhodes Grass and insecticides were incorporated into the surface layers of the soil by light discing. Good control was obtained with 1 lb. of technical Dieldrin per acre. One hundred per cent. pastures were established. Eleven to fifty per cent. of the pasture in the untreated plots failed to become established. Results are to be published in the *Rhodesian Agricultural Journal* (Dr. C. Taylor and C. N. Smithers).

CUTWORM INVESTIGATION

Cutworm is a serious pest of many agricultural crops. During recent years cutworm damage has been particularly severe in the Gatooma area. Trials were carried out at two farms near Gatooma. Various insecticides were compared as seed dressings, dust in drills and dust on top harrowed into the soil. The results were not conclusive but they indicate that seed dressings are unlikely to be useful as a control measure against this pest. Placement of insecticides, notably Dieldrin around the base of plants, was found to be successful when the soil was moist. It was concluded that Dieldrin applied under hot dry conditions should be worked into the top two inches of soil.

INSECT SURVEYS, HENDERSON RESEARCH STATION

Fortnightly visits were made to Henderson Research Station to collect data on the biology and seasonal abundance of insect pests of a wide variety of vegetable and seed crops. The observations have been valuable as guide to advisory work with special crops.

INSECTICIDE TRIAL—CASTOR BEANS—GWEBI COLLEGE

Inconclusive results were obtained from a trial at Gwebi College in which the insecticides Sevin, DDT and Dieldrin were compared for control of insect pests. Apart from a few looper caterpillars *Achaea sp.*, which were easily controlled, insect attack was light. A late attack by Botrytis affected results.

ROOT-KNOT EELWORM (Senior Helminthologist)

(a) *Host-parasite relationships*

Pure line cultures of the four species of root-knot eelworm found in the Federation have now been bulked up in experimental pits. The stage has now been reached for more fundamental studies of host-parasite relationships during the coming season.

(b) *Longevity Experiment*

This experiment was started in 1958. Three soil types were artificially infected with *Meloidogyne javanica*, and the infestation built up by growing susceptible crops. The plants were cut down and the soils maintained free of vegetation in 120 drums in a randomised distribution. At three-monthly intervals drums of each soil type are removed and planted to tomatoes. At the end of a further three months the tomatoes are examined and given eelworm ratings. All soil types remain infested after 12 months fallow, and the infestation has persisted at a higher level in red and sandy soil when compared with clayey black soil. The experiment is continuing.

(c) *Survey.*

Root-knot eelworm has been found infesting 425 different species of plants (573 varieties) in the Federation. An up-to-date host list has been published in the *Rhodesian Agricultural Journal* giving ratings for each species of eelworm as far as is known. Following another year's work the evidence more than ever suggests that *M. javanica* is indigenous. This has been supported by an extensive survey in wattle plantations.

(d) *Susceptibility Trials.*

I. *Grasslands Research Station.* An infestation of *M. javanica* has been built up by growing susceptible crops. Land has been planted with 100 varieties of legumes, mainly clovers. It is hoped that resistant varieties will be found.

II. *Gatooma Research Station.* A small plot of land is being artificially infested with *M. javanica.* It is the intention to carry out similar susceptibility trials with varieties of kenaf and dhal.

III. *Salisbury Experimental Station.* A heavy infestation of *M. arenaria* discovered on a plot at the Salisbury Experimental Station is to be maintained and encouraged for one year by growing susceptible crops. It is hoped that this land will then be used for testing a wide range of crops against this species.

PESTS OF LUCERNE

A preliminary study of the insects associated with lucerne was started, and a more detailed investigation of the biology and ecology of the lucerne butterfly was continued. This formed the subject of a paper "Preliminary remarks on Insects Associated with Lucerne in Southern Rhodesia", written by Mr. C. N. Smithers and presented by the Chief Entomologist at the Professional Officers' Conference in Salisbury. A paper "Preliminary observations on *Colias electo L.* in Southern Rhodesia" has been written for publication.

ADVISORY SERVICE

Recorded enquiries received numbered 561. These do not include increasing numbers of enquiries being received by the entomologist stationed in the Eastern Districts. Since an entomologist has been stationed at Umtali there have been better opportunities to examine the special problems in the area and the farming community are making more use of the advisory service.

Generally, advisory tours were limited by mileage restrictions. However, one tour was made in Northern Rhodesia by the Chief Entomologist in conjunction with a Plant Pathologist. Corn root-worm caused extensive damage to young maize in parts of Northern Rhodesia during December and advice was given on measures to be taken for control.

The following are some of the more important pests which were repeatedly of concern to farmers: Potato tuber moth; cutworm on various crops; barley aphis, *Rhopalosiphum madis* on maize; Tobacco aphis; citrus pests, scale insects and aphis; and root-knot eelworm. Tobacco aphis, *Myzus persicae* was more widespread than usual. There were no major outbreaks of army worm.

A new pest of strawberries to Rhodesia since identified as *Tortrix dinota*, was discovered causing leaf roller damage in a market garden near Salisbury.

A number of talks were given to garden clubs and conservation officers and a course of lectures was again given to students at Gwebi College.

An exhibit was presented at the Salisbury Agricultural Show and officers also attended the Umtali Show.

PHYTOSANITARY SERVICES

The Plant Pests and Diseases (Importation) Regulations, 1958, were published early in the year. An amendment prescribing conditions governing the import of fresh citrus fruit has since been gazetted. This was necessary for tighter control of entry of certain diseases of citrus, citrus black spot and citrus canker.

During the first year of Federal control of phytosanitary services some difficulties have been experienced in the Northern territories. These were largely due to the absence of trained staff for the implementation of the regulations in Nyasaland and Northern Rhodesia. Plant Inspectors will be required for these territories. The co-operation being afforded by officers of the Federal Department of Customs and Excise is appreciated.

The system of issuing annual permits to approved nurseries in the Union of South Africa has been discontinued. All registered nurseries in the Union are granted special privileges for export of plants to the Federation without permit, subject to certain conditions.

Large numbers of consignments of roses were refused entry from one nursery in the Union because of heavy infestation by root-knot eelworm. This action resulted in later importation from the same nursery arriving free of root-knot eelworm.

A total of 628 special import permits were issued during the year, and 30,307 consignments, 784,081 packages were dealt with by Plant Inspectors at Salisbury, Bulawayo and Umtali. For the first time inspections were made of local fruit grown in the Eastern Districts.

Seventy plant nurseries are now registered in the Federation. The majority of these were inspected early in the year. More attention is being given to inspections for root-knot eelworm.

Phytosanitary certificates were issued in respect of 172 consignments of plants or plant products for export.

The system of issuing Tobacco Removal Licences has been abolished and Tobacco Premises Licences are now only required for such premises as defined in the Plant Pests and Diseases Act, 1958. Seventy-five Tobacco Premises Licences were issued, and this compares with 4,471 Tobacco Removal Licences issued the previous year.

Four thousand, seven hundred and twenty-three inspections of farms and premises were made. Most tobacco farms were inspected twice except in Sinoia, Eastern and Northern Rhodesia areas, where they were inspected once.

Legal action was successfully taken against 13 farmers who failed to destroy tobacco plants by the due date. It is of interest to note that nearly all the prosecutions were necessary in areas in which farms could only be inspected once.

There were the usual number of minor infringements of the regulations, such as lack of attention to regrowth in lands and seed-beds, and farmers were persuaded to take the necessary remedial action.

Twenty-six infestations of live cigarette beetle were discovered in stored tobacco premises. The tobacco was required to be fumigated and residual insecticides were applied in the premises in all instances.

Three visits were made by the Senior Tobacco Inspector to Beira. The visits were arranged so that spraying of the transit sheds with insecticide was seen at the same time. No live pests were found in tobacco in Beira.

PUBLICATIONS

In the *Rhodesian Agricultural Journal:*

1. "The Bean Stem Maggot", by C. E. Taylor (Vol. 55, p. 634).
2. "Plant Imports and Exports." A Synopsis of the Federal Regulations, by J. A. Whellan (Vol. 56, p. 28).
3. "Control of Root-knot Nematodes", by G. C. Martin (Vol. 55, p. 65).
4. Report of the Chief Entomologist for the year ending 30th September, 1957, by J. A. Whellan (Vol. 56, p. 113).
5. "Pests of Cabbages and Related Crops", by C. E. Taylor (Vol. 56, p. 159).
6. "Plants Attacked by Root-knot Nematodes", by G. C. Martin (Vol. 56, p. 162).

In *Nematologica*:

1. "Plant Species Attacked by Root-knot Nematodes *(Meloidogyne* spp.) in the Federation of Rhodesia and Nyasaland", by G. C. Martin. Nem. 4 (1959) pp. 122-125.
2. "Root-knot Nematodes *(Meloidogyne* spp.) in the Federation of Rhodesia and Nyasaland", by G. C. Martin. Nem. III (1958), pp. 332-349.

HORTICULTURE

C. N. HAYTER

Senior Horticulturist

After a long post-war run of continual increased demands for horticultural produce, the drop in immigration credit restrictions and reduced trading brought about considerable marketing difficulties. This especially affected vegetables where an hitherto expanding market suddenly ceased to exist.

A number of growers were hit by wholesalers being unable to meet their commitments and whose business failed. This had the effect of diverting much larger supplies of produce to the Salisbury Municipal Market; also of Eastern District growers relying less on Salisbury as an outlet, and making better use of local processing factories.

As a sign of the times, far more requests were received for horticultural employment than previously.

CLIMATIC CONDITIONS

Early rain fell in the latter part of October followed by hot, dry weather until mid-December. Some leaf scorch of vegetable crops occurred, due to excessive transpiration. Sunny spells in January did much to keep summer fungus diseases within control.

Heavy rains in February made vegetable growing more difficult. Rains ended in mid-March which allowed growers to get on to their lands earlier than usual, for successive cropping.

Except for slight frost damage early in the season, the winter was again mild with minimum temperatures above average. But cold nights persisted late into spring and delayed growth of tender crops.

FRUIT

Citrus.—Current season cropping of oranges and naartjies was heavy, but fruit was well absorbed at slightly lower prices. Only growers who paid little regard to appearance and quality of fruit suffered low prices.

Extended planting of oranges and naartjies continued in many areas; farmers are finding that good local outlets are available for fruit, especially to Africans. Scope also exists for more late season crops of Valencia oranges which currently realized up to 22s. 6d. per 30 lb. pocket in January. Nursery trees were in good supply.

Indications of rust mite markings on oranges were seen on consignments from several districts which were marketed in Salisbury. Magnesium deficiency of citrus generally has become more pronounced.

Sales of Southern Rhodesian citrus for 1957-58, including fruit used for processing by the Mazoe Citrus Estates, totalled £164,000.

No fresh fruit was exported. The export of concentrated orange juice was valued at £72,000. Some inquiries were received in respect of oranges for export but no surplus fruit was available in sufficient quantity.

A changed system of recording of fruit trees was introduced by the Statistical Office for the past year. Instead of the number of trees, the acreage under specific types of fruit trees was used.

The totals in respect of Southern Rhodesia for 1957-58 were:

Oranges	4,380 acres.
Other Citrus	860 acres.
TOTAL	5,240 acres.

SUB-TROPICAL FRUIT (OTHER)

A further year free from damaging winter frosts was welcomed in getting young plantings established, such trees being more sensitive in the first year or two.

Bananas.—The Southern Rhodesia acreage of bananas increased from 289 to the 1957-58 total of 470 which, while encouraging, is still small in relation to

our fruit requirements. Federal imports of bananas were valued at £149,000 for 1958, all being of the Cavendish variety from Portuguese East Africa.

Excellent quality fruit was grown in the Sabi Valley for sale in Salisbury. Several inquiries were received about banana-growing possibilities.

Fertilizer experiments are under way in the Eastern Districts. The trial plantings of Gros Michel variety at the Sabi Valley Research Station have grown well.

Papaws.—New plantings of the Hortusgold variety have been made in the Cashel Valley, both for fresh fruit sales and to the factory for pulp. Small consignments of early season fruit from the Eastern Districts were marketed in Salisbury. Good prices were realized; there is scope for greater supplies.

For late season fruit the "Solo" papaw variety can be used once it becomes more popularly known.

Pineapples.—The Queen pineapple is being produced in a relatively new low altitude district east of Headlands known as Mayo where much interest is being shown in horticultural cropping. A trial commercial acreage of the Queen variety proved most satisfactory, the fruit being of good size and quality.

Some difficulty was experienced at ripening time with pineapples at Chipinga, the fruit having water soaked areas in the flesh. This has curtailed further planting. Earlier harvesting would be helpful.

The recorded acreage of pineapples in Southern Rhodesia for 1957-58 was just under one hundred.

Avocados.—Small, increased plantings of avocados were made, the variety Fuerte being in greater demand commercially. Damage to young trees by buck has been reported from Melsetter.

An experiment in Salisbury on fruit picking which covered a harvesting period of six months, proved that with some varieties, once the fruits reach full-grown size, they ripen satisfactorily without being left to hang for weeks on the trees. This not only means a longer marketing period, but is less strain on the trees. Increased yields are also obtained.

Sub-tropical Fruit Trees (excluding citrus).—The changed system of tree census recording by the Statistical Office, introduced in 1957-58 for simplification, does not define the different kinds of sub-tropical fruit trees. The total acreage given is 2,120 and is described as mixed. Recorded fruit sales are too sparse to quote.

Deciduous Fruit.—Trees suffered to a marked extent due to an incomplete resting period brought about by the mild winter. Dormancy was delayed and spring growth sparse and late. More growers to-day are practising D.N.O.C. dormant spraying to stimulate spring growth of apple trees.

Apple crops were light, peaches good, while plums proved to be an all time record crop.

Marketing.—The Eastern District Fruit Pool collective marketing scheme for wholesale distribution of deciduous fruit, ran into agent distribution difficulties in Salisbury the first week of the season and some consignments of plums were lost. Fortunately it was possible to rapidly carry out an alternative system of supplying direct, which worked satisfactorily for the season.

It was necessary to put some consignments of Santa Rosa plums into cold storage for a week or two and also delay the importation of supplies from South Africa until the end of December. Quality and packing of fruit generally were good.

Fruit Inspection.—A voluntary scheme of inspection of graded local deciduous fruit was commenced on behalf of the Eastern Districts Fruit Growers' Pool. The work is being carried out by the Plant Inspectors at the central railway stations.

Fruit Tree Plantings.—A local census of deciduous plantings shows that peach trees are more extensive in the areas of Umtali and Cashel while apples have been more popularly planted in the Inyanga District. There is a need for more pears for canning, plantings being few.

It has been arranged to obtain more detailed records of tree totals by variety and age to give a more complete picture of the industry.

Grapes.—A continuance of planting took place, many being of small trials and to obtain cuttings for stock. Numerous inquiries were received for general

information on grape growing. At Karoi a six-acre planting of Queen of the Vineyard variety, trained on overhead trellis, commenced cropping. It shows good promise.

The aim of the Vinegrowers Association of Southern Rhodesia is plantings for wine-making. At a farm at Rusape a large quantity of red wine from the Isabella variety was produced and placed on the market.

Deciduous Fruit Tree Statistics.—The only figures available for Southern Rhodesia for 1957-58 are:

Apple Trees	680 acres.
Peach Trees	190 acres.

Values of fruit sold are too meagre to quote.

Fruit Importation.—Federal imports of the various kinds of fruit for 1958 were:

	Tons (2,000 *lb.*)	£
Deciduous Fruit	5,682	322,000
Bananas	9,460	149,000
Grape and Miscellaneous	2,033	95,000
Citrus	1,287	21,000
Other Sub-tropical	1,011	42,000
TOTAL	19,473	£629,000

This shows a marked increase in deciduous fruit of £47,000 over the previous year, and illustrates our need for greater self-sufficiency.

COFFEE

More interest was shown in coffee planting especially in the Chipinga district. Most plantings can be given supplementary irrigation.

Of the total Southern Rhodesian recorded acreage of 117 for 1957-58, only nine are in production.

TEA

Tea acreages continue to increase, the total area for Southern Rhodesia being 2,800 acres for 1957-58, of which 1,700 are in production. The yields totalled 1,389,000 lb. Older established estates are situated in the Chipinga district with more recent plantings in low altitude country of Inyanga.

VEGETABLES

With a recorded total of 4,390 acres of fresh vegetables grown in Southern Rhodesia under irrigation in 1957-58, this represents a slight reduction from the previous year.

Vegetables during the rains in Salisbury were more plentiful than for some years, the only short supply period occurring in March, due to heavy rains. Standards of production continue to improve with resultant increased yields. More attention is being given to pest and disease control.

Molybdenum deficiency, the common trouble of cauliflowers, has now shown up in cabbage crops in market gardens. Some varieties appear to be much more susceptible than others.

Tomatoes are being grown on a much larger scale than previously. The most concentrated area of production is Cashel, closely followed by Melsetter. A more even price range resulted from continuity of supply. Some puffiness in tomatoes was observed during the early winter when there was a wide variation between night and day temperatures.

Fresh Vegetable Imports.—Federal imports in 1958 totalled 2,700 tons valued at £78,000, a slight increase over the previous year. Bulawayo absorbs the largest quantity of these imports. The lower wholesale prices offered in Bulawayo are responsible for lack of interest in vegetable production in Matabeleland. The imposition of 1d. duty on imported vegetables for a two-year trial period should encourage local growers.

Onions.—Onion acreages continued to increase. For 1957-58 in Southern Rhodesia, 400 acres were cropped and gave a yield recorded as 26,500 bags (120 lb.). Commencing with the current year an extra two-month protection

period was introduced for August and February. Onions imported during these times bear 1d. per lb. duty. This has already proved effective in encouraging earlier cropping and should extend the storage of mid-season crops.

Growers have been encouraged to plant higher populations to obtain more medium-size bulbs.

Federal importation for 1958 was higher at 55,200 bags, due partly to the very large quantity available in South Africa at prices lower than usual.

Vegetable Research.—Vegetable experiments and trials were continued at the Henderson Research Station, Mazoe, the crops being onions and cauliflowers. These and other vegetables were also grown for seed.

Nurseries; Planting Material; Cut Flowers.—More interest is being taken in local propagation of nursery trees and plants. Registered nurseries have increased to 67 in Southern Rhodesia. Imports of bulbs, plants and trees for the Federation in 1958 were valued at £45,000 (last year £64,200).

Commercial flower production has increased, especially carnation growing. Flower imports for 1958 totalled £9,800. (Last year £15,200).

ADVISORY SERVICES

A considerable amount of time was devoted to specialist advisory work in all aspects of horticulture. Correspondence and Head Office duties, which included an increased number of personal calls requiring information, greatly reduced the time available for field work and advisory visits. Requests were considerable for all forms of service. It is regretted that it was impossible to follow up advisory and investigational work.

With regard to advisory visits on behalf of and in conjunction with Officers of the Department of Conservation and Extension in many parts of the Colony, it was impossible to pay all the individual farm visits requested. Meetings at collective centres for horticultural talks, demonstrations and discussions was resorted to.

The Senior Horticulturist gave six lectures on fruit and vegetable growing and marketing to senior students at the Gwebi Agricultural College. Three lectures on similar subjects and on potatoes were given to officers attending the Irrigation Course of the Department of Conservation and Extension.

Conservation and Extension annual conferences at the Midlands and Umtali centres were attended by the Senior Horticulturist, who led the discussions on the horticultural papers presented.

COMMITTEES

The Senior Horticulturist served on the following committees during the year:

Departmental Fruit Imports Advisory Committee.

Departmental Show Exhibits Committee.

Departmental Potato Technical Committee.

Rhodesia Vegetable and Flower Seeds Association.

Rhodesia Agricultural and Horticultural Society, Salisbury.

Salisbury and District Garden Club Committee.

Federation National Seed Campaign Committee.

He is also Official Correspondent to the Commonwealth Bureau of Horticulture and Plantation Crops, United Kingdom.

Horticultural Articles.—Numerous articles on horticultural crops were prepared for a farming handbook. A number of papers written by other officers and outside correspondents dealing generally with horticulture and such crops, were received for attention before publication.

Agricultural Shows.—The Senior Horticulturist judged fruit, vegetables and flowers at agricultural and/or horticultural shows at Bindura, Sinoia, Gwelo, Bulawayo, Marandellas and Salisbury. At most shows the entries were fewer than usual. An educational exhibit, showing magnesium deficiency of apple and citrus trees, was staged at the Salisbury Agricultural Show.

RHODES INYANGA ORCHARDS

Climatic Conditions.—Rainfall for the year totalled 52.54 inches, there being 113 rainy days. Ground frosts occurred on 57 nights; the absolute minimum ground temperature recorded was 19.8°F. on 15th June.

Mean temperatures during the critical month of dormancy of deciduous fruit trees were: June, 51.3°F., July 51.2°F.

Fruit Crop and Sales.—Following last year's heavier apple yields, trees had a correspondingly low yield, as is the usual biennial pattern. Total fruit sales were £835 (1958, £1,721). First and second grade fruit was sold through the Eastern Districts Fruit Growers' Pool and 3rd grade to the Salisbury Municipal Market. Quantities of below-grade apples and 3rd grade pears were sold to the Umtali canning factory for processing. The pears were for commercial canning trials, which proved a success.

Research Work.—At the meeting of the Research Advisory Committee held at the Orchards in April, members were in full agreement that the older orchards were now not suitable for critical research. It was agreed that an adjacent site of approximately 40 acres—having been proved satisfactory—should be developed and a start made with new plantings.

For the time being, work was to be continued with the established orchard at least until the new site was well advanced.

Development.—Land was cleared, graded and fenced for a new nursery. As eelworm was found on volunteer wattle trees, it was necessary to fumigate the soil. A piped supply of water was also laid on to avoid contamination by the use of open furrows through infested land.

Nursery Work.—Nursery beds were prepared and 100 apple root stocks of Merton 793 planted, plus other local ones. Seed of apple, pear and peach were sown for stock.

Irrigation.—The irrigation experiment of Kakamas cling peaches, continued for the second year, confirmed first year results. Greatly increased yields and larger size fruit were obtained from the trees that had been irrigated as compared with controls.

Less cracking of Ohinemuri apples occurred on trees that had been irrigated. It was possible to considerably increase irrigation facilities for the following seasons to include a wider range of varieties.

Apple Nutrition.—Nitrolime applications to paired tree plots still gave inconclusive results and with no noticeable increase in leader growth. Similar trees outside the experiment, of the same variety, did however respond to tip pruning.

Soil applications of magnesium sulphate and dolomite lime to apple trees have yet to give the marked improvement expected.

Fruit Cropping (General).—Of the various kinds of fruits, the nectarine variety Goldmine, and apricot Bulida are the most promising of the varieties represented.

Since Red Delicious apple was introduced as a pollinator for White Winter Pearmain cropping has improved considerably.

Miscellaneous.—Some advisory visits by the Orchards staff were paid to growers in the area. A comprehensive description of apple varieties and their behaviour, written by the Horticulturist (Mr. C. B. Payne) was published in the *Rhodesia Agricultural Journal* issue of January-February, 1959.

PASTURE RESEARCH

DR. OLIVER WEST, *Chief Pasture Research Officer*

INTRODUCTION

The need for a central organization for the Branch of Pasture Research and Ecology stressed in the Annual Report for 1958 becomes increasingly urgent. It is regrettable that no progress has been made in this direction.

BASIC RESEARCH IN VELD AND PASTURE PROBLEMS

With the foundation of the *Agricultural Research Council* and the present stress on the differences between basic or fundamental research and applied or husbandry research, it behoves us to take stock of the work of the Pasture Branch to see where we are going and to decide whether the work we have in hand is on the right lines and sufficient not only to take care of the present but to provide for the future.

The present programme of Pasture Research in Southern Rhodesia began at Matopos and at Marandellas in 1945. It began in response to a growing interest on the part of farmers and the general public in the role of veld and established pasture in our agriculture and because of a widespread demand that the work that was giving such promising results in neighbouring territories and particularly in the Union of South Africa should be started here.

It began during a cycle of dry years and its inception was followed by the disastrous drought of the 1946-47 season and the bad years which followed. The poor state to which our veld had been reduced, both in the Native Reserves and on European farms, the heavy cattle losses which were being experienced and the almost complete absence of knowledge of veld management in the drier country and of the establishment and role of pastures in the region of higher rainfall, forced the attention of the newly recruited pasture staff to a consideration of the immediate objectives rather than to a dispassionate investigation of the basic principles involved. This attitude was necessary because there was no extenson service and because it was the responsibility of the research worker to advise both European and Native agriculture.

With regard to the veld, the position—as can be judged from headlines in the *Bulawayo Chronicle* of those years—was desperate and advice on the management of natural grazing was urgently required.

On the established pasture side, the lack of knowledge was just as great. The acreage of established pasture was microscopic and there were few grasses that could be used in pastures.

There was little or no appreciation of the importance of the grass ley in arable rotations even in the high rainfall sandveld, where the accepted practice was to grow tobacco in a 15-20 year bush fallow rotation.

The work which commenced in 1945 and has progressed through the years, succeeded in no uncertain measure in its immediate objectives.

This is to the credit of the workers who planned our original approach and who, despite the urgency that existed to satisfy current needs, succeeded in implementing a programme that was largely basic in nature.

(It is of interest to note that some of the first field trials put down at Matopos were planned to run for 15 years.)

From these experiments our knowledge of the broad principles of the ecology of our natural pastures has been vastly increased. We have gained a working knowledge of the effect of fire and of the limitations of the vegetation. We have been enabled to construct simple and easily applicable systems of veld management that work, and can give definite and intelligent advice on many of the problems that are brought to us.

For our arable agriculture we have discovered new and promising seeding grasses and have learned much about their establishment and management in pastures. We have studied the response of pasture grasses to fertilizers and have demonstrated their ability to maintain and build up soil fertility. We have shown how important pastures can be in increasing animal production.

By concentrating on the immediate objectives, too steadfastly perhaps, *Pasture Research* has succeeded in providing much of what is needed for

application in the agriculture of to-day, but in so doing it has perforce neglected the more fundamental issues and has placed itself in a position where with no clear policy and no definite target, it is in danger of running down.

The time is opportune for a switch in emphasis. There is now in existence an able and well-equipped extension service, which is concerned with current practice and to whom we can feed the information required to deal with their day to day commitments.

We must divorce ourselves sufficiently from our preoccupation with *ad hoc* problems to find sufficient time to consider less immediate interests and to develop and foster the basic projects which are necessary for the preservation of the vigour of our effort and for providing the information we will need in the future. The work of the Pasture Branch is clearly divisible into two quite distinct sections:

(1) The ecology of the natural vegetation and

(2) The problems concerned with the establishment and ultilization of permanent and ley pastures.

The need for fundamental research applies equally to both sections and while it is obviously impossible to deal with the full scope of this research in this report, an attempt will be made to select some of the problems on which fundamental studies should begin.

1. Ecology of the Natural Vegetation.—Our work here has in the main consisted of a very generalized approach to the mass relationships of the major plant communities—the bush and the grass and their reaction to—

(a) Grazing at different seasons, at different intensities or stocking rates.

(b) The effect of fire at different seasons and at various intervals in the presence and absence of stocking. This is fundamental work, and a great bulk of very important results have been accumulated with regard both to the reaction exhibited by the vegetation and to the effect of the treatments on the grazing animal. In addition many side effects of importance have been observed and in some cases followed up. Limitations imposed both by staff and by their preoccupation with the more practical aspects of the projects have resulted in the exclusion of the detailed and less obviously practical studies which, if they could have been carried out simultaneously, would have enriched the investigation and be showing the way to the solution of problems which are facing us now.

Urgently necessary for a proper understanding of the complex, which we call veld and more particularly to elucidate the problems concerned with *Bush and Bush encroachment* are the initiation of detailed and fundamental studies (a) in *Plant Succession* and (b) in *Competition* both in the course of the secondary succession and in established communities.

(c) *Autecological studies* involving the establishment of seedlings, and the rate of root and shoot development in seedlings as well as studies of the shape and extent of the root systems of mature specimens of all important species of grasses, forbs and trees on different soil types.

(d) We need a much more detailed and fundamental approach to the effect of fire both on the vegetation and on the soil and a study of the mechanisms by which plants resist or escape the effect of fire (e.g. in grasses, the nature and position of primordial buds, etc.).

(e) The role and importance of leguminous trees and herbs.

(f) The effect of the different components of the vegetation on the water content of the soil.

(g) The inter-relationship and seral status of the various major plant communities. This should go hand in hand with detailed and accurate mapping of the plant communities.

2. Problems concerned with the Establishment and Utilization of Permanent and Ley Pastures.—As in the field of *veld ecology* our progress in this section has been very heartening. By a combination of introduction from the wild, and selection first in nursery beds and then in the field, we have brought into cultivation grasses that go far to satisfying our immediate needs. Much has been

learned about the propagation of these grasses, their establishment in monospecific pastures and about the management and potential of these pastures. The response of single species stands to fertilizers, particularly nitrogen, has been investigated more especially in the high rainfall sandveld, where, because of the universal acceptance of the need for pastures or leys in agriculture, much of this work has been concentrated. We have learned a lot about the soil protecting and soil fertility building properties of these pastures and how to use them as leys in arable rotations, but in this section as in *veld ecology*, the need for the detailed and precise information which can be provided only by basic and long range researches is very marked.

Apart from the work on the effect of grass leys on soil fertility, the recently initiated investigation of the rhizobial relationships of legumes and the investigations that are being carried out on the effect of various cutting and fertilizer treatments on the root reserves and on the vigour of cultivated grasses, there is little work of a fundamental nature in progress. Promising fields for future work include:

(a) *Plant Introduction.*—The Federation and the territories which border it are particularly rich in species, strains and ecotypes of grasses which are potentially useful in tropical and sub-tropical agriculture, not only in in Africa but throughout the world. It is essential that this material should be collected and investigated.

Very necessary is an investigation of the *cytology* and *genetics* of the numerous promising strains and ecotypes that have already been collected, as are studies of their response to the various factors of the habitat or environment and of their root reserve replenishment cycles under different intensities of utlization.

(b) *Limitation of Yield.*—By comparison with results obtained in the United States of America and other countries the yields obtained from established pasture in Southern Rhodesia are often low and there is a marked reduction in yield in second year and older stands when compared with yields obtained in the season of establishment. The reasons for this reduction, which appears to occur despite adequate fertilization, are obscure. It would appear that it is not entirely due to the slowing down of the mineralization of nitrogen, which we have come to expect in established pastures, but is contributed to by other effects about which we know very little. Contributory causes possibly include:

(i) the effect of management on the vigour of the grasses and in this connection it is important that the fundamental studies in progress on the effect of treatment on the replenishment of root reserves and the nature of the replenishment cycle in different grasses and in grasses of different growth habit should be extended;

(ii) depletion of the water in the soil to considerable depths by deep-rooted perennial grasses is possibly very important, and it is essential that studies of the nature of the root systems and of the use of water to the full depth of the root system and its replenishment by rain at the end of the dry season, should be begun as soon as possible. Obviously these studies could usefully be supplemented by studying the productivity of dry-land summer grasses under irrigation;

(iii) we have no knowledge of the effect of the various limitations imposed by our climate on the productivity of the grasses we cultivate. It is essential that we should begin to study the effect of the limitations imposed by the amount and distribution of the rainfall, the temperature during the growing season, the short days characteristic of our latitude, the intensity of the sunlight, etc. A knowledge of the effect of the various factors of the environment on the yield of the different grasses we can use in our pastures, would be of great assistance both in evaluating the grasses and in comparing our results with those obtained in other parts of the world.

(c) *Grazing Management.*—The employment of tracer techniques for the measurement of intake in studying problems concerned with the management of animals on pasture has made possible an objective and quantitative approach to what was often regarded as an art rather than a science. In New Zealand and in Britain investigations which these

techniques have made possible, are producing unexpected and very important results. Here, where the pasture species are very different, there is a vast untrodden field awaiting investigation, particularly with regard to the dairy cow on rain-grown pastures.

(d) *The Grass/Clover Pasture.*—The problems of management, formidable enough with monospecific grass pastures, have recently been complicated by the successful introduction of deep-rooted perennial and summer growing annual clovers from East Africa, which in preliminary trials show promise of extending very greatly the area in which grass/clover pastures can be grown under natural rainfall. This brings to the fore a whole range of problems concerned with fertilization and management about which we are entirely ignorant.

It is obviously impossible to list in detail the numerous aspects which call for fundamental research. I have not attempted to do this, but have selected a few lines in which the need for fundamental investigations is very obvious, in the hope of encouraging support for work of a fundamental nature in the ecology of the natural vegetation and in the field of established pastures.

MELSETTER PASTURE STATION

The Melsetter Station serves a region which is ecologically and agriculturally very distinct from the rest of Southern Rhodesia. The area served is mountainous and comparatively inaccessible. It is a narrow strip stretching along the Eastern Border from Mount Selinda to Inyanga and is characterized by a highly dissected and steeply sloping land surface. The disadvantages imposed by the broken nature of the country and the very small proportion of the land that is suitable for cultivation, is compensated for to some extent by a high and reliable rainfall and by the fact that a fair amount of rain falls during the dry season. This is sufficient to maintain European clovers, which flourish during the summer in dry-land pastures, something which is impossible elsewhere except under irrigation or in vlei land.

The region is therefore very suitable for pasture development, fruit growing and afforestation with exotic pines and wattles.

The geographic location of the pasture station is a disadvantage under which it has always suffered. Situated at the extreme southern end of the region it serves, it is out of touch with the majority of the farmers it is supposed to serve.

An important step, taken during the year, should help considerably in improving this situation. This was the formation of a Liaison Committee on which farmer members representing the Eastern Group of I.C.A.s sit with representatives of the Federal departments of *Research & Specialist Services* and *Conservation & Extension* to assist in guiding the Station's policy and in maintaining close liaison between the Station and the farmers it serves. The first meeting of this committee was held at Melsetter in September, 1959, and at this meeting a strong wish was expressed by the farmer members that the scope of the work of the station should be broadened. This has been met to some extent by the stationing of an extension horticulturist on the Station where, in addition to his advisory work, he will be able to undertake some investigational work in connection with fruit and vegetable growing.

The Weather.—Useful rains during the winter of 1958 and heavy rain in October was followed by a long dry and very hot period in November, 1958, which had a most depressing effect on the production of the grass/clover pastures. Rainfall during the rest of summer was good and the total rainfall for the year ending 30th April, 1959, amounted to 43.12 inches. During the winter of 1959 rainfall has been very good, averaging over an inch per month for April, June, July and August.

The Dairy Herd.—The year marked the beginning of a new policy—to concentrate on summer milk and on the sale of in-calf heifers. This will enable the Station to study the production of milk from summer pastures when past work has shown the pastures are productive and capable of producing milk without the supplementary feeding of concentrates, and will provide an outlet for the separated milk in the feeding of dairy heifers, thus providing, it is hoped, an additional and badly needed source of income.

To implement this policy all cows and heifers were served in late January and during February (21/1/59—3/3/59) to calve down at the beginning of the 1959-60 growing season. Culling was continued to reduce the herd to 20 cows in milk and 11 old cows were disposed of in August.

Despite a shortage of grazing at certain times during the season the milking herd is in very good shape and the cows have never come through the winter in better condition.

The Sheep.—The present policy with this flock of grade German Merino ewes is to lamb in October and to sell lambs straight from their dams at weaning time. In January, 1959, the previous year's lamb crop averaged 65½ lb. at weaning and it is hoped that this will be bettered in the coming season. During the summer the flock followed the cows on the pastures. They were wintered on these dry-land summer pastures where they remained until the middle of September, 1959. From the middle of September they were removed to irrigated pasture for flushing preparatory to lambing in October. The flock is in excellent condition and it has not been necessary to feed any concentrates at any time during the year.

Pastures.—An investigation into the apparent decline in the productivity of old pastures has been commenced. This includes a series of fertilizer trials to measure the response of pastures of various ages to different levels of N, P, K and lime. During the year in an establishment trial with clovers on virgin soil, very striking responses were obtained to applications of superphosphate and lime, the clover failing entirely on the plots to which no superphosphate was applied.

Eight different varieties of lucerne have been established in a variety trial, which is being put down at a number of stations throughout the Federation.

Preliminary work has been started on the establishment of Paspalum and on over sowing of Kikuyu pastures with Italian rye grass.

Interesting and promising introductions include Sabi *Panicum, Cajanus indicus* and a range of East African *Trifolium* species.

Crops.—In a variety trial with potatoes *Pimpernel, Loman* and *Walanga* all proved superior to Up-to-Date. There was no significant difference in the yields of the three better varieties.

In a registration trial for the varieties Wilpa, Dekama, Surprise and Ackersegen the total yield of tubers obtained compared as follows:

Ackersegen	100%
Wilpa	89·9
Dekama (Engelum D 1133) . .	86·2
Surprise	64·6

A trial of summer wheat varieties was a failure because of bird attack.

THE RESEARCH STATIONS

Reports dealing with the activities of this branch on the *Grasslands, Matopos* and *Henderson Research Stations,* on the *Pasture Sub-Stations* at *Tuli* and at *Nyamandhlovu* and at the *Gwebi Agricultural College* will be found in the appropriate sections.

PASTURE SEED PRODUCTION

The quantity of pasture seed harvested during the 1957-58 season again showed a very considerable increase over the crop of the previous season yet despite this the demand exceeded the supply and no difficulty was experienced in selling the entire crop.

The following table shows how this crop was made up.

Grass seed produced in Southern Rhodesia 1958	Katambora Rhodes Grass	Giant Rhodes Grass	Bambatsi Panicum	Sabi Panicum	Weeping Love Grass	Totals
	lb.	lb.	lb.	lb.	lb.	lb.
Certified Seed . . .	33,402	3,740	—	96	4,185	41,423
Uncertified Seed . . .	27,486	2,591	1,412	—	24,422	55,911
TOTALS	60,888	6,331	1,412	96	28,607	97,334

(This table includes only the seed sold through the official agents to the R.S.P.G.A.)

Figures for the 1958-59 crop are not available yet but preliminary estimates indicate another big increase in the total crop which is expected to exceed 50 tons.

HERBAGE PLANT INTRODUCTION

This work, at present the personal responsibility of the Chief Pasture Research Officer, is too important and demanding to be dealt with on a part-time basis. There is a very real need for the appointment of a full-time professional officer to take charge of the nurseries and to conduct the preliminary screening of new introductions.

During the year interesting material has been introduced from Kenya, Tanganyika, Bechuanaland and from several localities in Northern and Southern Rhodesia.

Requests for seed received from a number of institutions and individuals in other countries have been complied with.

ROAD VERGE VEGETATION

Co-operation between this Branch and the Southern Rhodesia Department of Roads and Road Traffic, in a search for suitable grasses for road verges, continues.

Katambora Rhodes Grass proved very successful in an experiment on the Falls Road, while *Star No. 2* has shown considerable promise in several localities in Mashonaland. Two new trials of grasses for protecting road verges and embankments are planned for the coming season.

STAFF

The position with regard to staff is far from satisfactory. The Chief Pasture Research Officer has a multiplicity of duties with which, in the absence of any assistant or deputy, he is physically unable to cope. His duties entail a great deal of travelling and extended absences from office. When he is away there is no one to act for him.

In essential aspects of the work of the branch, such as the collection, introduction and trial of herbage plants and the undertaking of ecological and vegetation surveys, the lack of staff is virtually bringing the work to a standstill.

The important work, dealt with in this report under the *Ecology of the Natural Vegetation* cannot even be begun.

The difficulties with regard to staff go hand in hand with the need for a central organization which has already been stressed. If the branch is to fulfil its obligations it is essential that a better working arrangement must be arrived at.

COMMITTEES

The Chief Pasture Research Officer served on the following Governmental Committees:

1. Departmental Research Advisory Committee.
2. Federal Hydrological Co-ordinating Committee.
3. Natural Resources Board, Native Affairs Sub-Committee.
4. Tsetse and Trypanosomiasis Committee. (Representing the Director of Research and Specialist Services.)
5. Technical Advisory Committee. Rhodesia Pasture Seed Growers' Association. (Chairman.)
6. National Seed Campaign Committee.
7. Plant Introduction Committee.
8. Departmental Standing Committee on Weeds.
9. Noxious Weeds Sub-Committee.
10. Bush Control Sub-Committee. (Chairman.)
11. Crop Ecology Sub-Committee. (Chairman.)
12. Melsetter Pasture Station. Eastern Group of I.C.A.s Liaison Committee. (Chairman.)

ECOLOGICAL AND LAND USE SURVEYS

The Chief Pasture Research Officer visited the Bechuanaland Protectorate where he accompanied the Acting Director of Agriculture there on a tour of grazing areas.

He attended a *Working Party in Kenya* organized by E.A.A.F.R.O. to advise on grazing problems in the Baringo Native area, and in European ranching areas. Afterwards he visited the Pasture Research Stations at Machakos, Molo and Kitale with the Chief Pasture Research Officer, Kenya, and accompanied the Assistant Director of Veterinary Services in charge of Tsetse Control, Kenya, on a visit to bush clearing operations at Mara in Masaailand and on the western shore of Lake Victoria.

He toured European farming areas and visited experimental farms in Northern Rhodesia with the Department of Conservation and Extension.

He visited and reported on the Bandai Clearing for the Department of Tsetse and Trypanosomiasis Control.

He took part in a survey of the Gonakudzingwa area and Special Native Area "A" with the Native Affairs Department and visited the grazing experiments of that Department at Masera.

To assist officers of the Department of Conservation and Extension in studying the ecology of their areas he toured a number of I.C.A.s in both Southern and Northern Rhodesia.

He paid frequent visits to all of the Research Stations and sub-stations and kept closely in touch with the work of his branch on these stations.

CONFERENCES AND MEETINGS

The Chief Pasture Research Officer was responsible for organizing the *Professional* Officers Conference of this Department.

He attended the group conferences of the Department of Conservation and Extension at Bulawayo, Umtali and in Salisbury.

He lectured at Beef Courses in Que Que and in Bulawayo.

He attended and spoke at several I.C.A. and Farmers' Association meetings.

He judged pasture competitions in the Beatrice and Marandellas South I.C.A.s.

VISITORS

Professor Harold F. Heady, Professor of Range Management at Berkley, University of California, visited Southern Rhodesia from Kenya. He spent approximately ten days in the Colony, visiting all of the Research Stations. This was a most valuable visit and Professor Heady's advice has been of considerable assistance to us.

PAPERS

A paper on "Veld Management" was prepared for the Conservation Officer's Handbook. Roneoed copies of this paper are available on request.

ACKNOWLEDGEMENT

I am happy to acknowledge the very full and helpful co-operation I have enjoyed with the staff of the research stations during the year.

AGRICULTURAL EXPERIMENT STATION, SALISBURY

A. G. H. RATTRAY, *Officer-in-Charge*

SEASON

Although about five inches of rain fell in the latter half of October and early November, several weeks of dry weather followed and good planting rains did not occur until mid-December. Some maize and velvet beans were planted in early November and just managed to survive the dry spell. Main plantings were not made until the coming of the general rains so that maize, soya beans, groundnuts, potatoes and sweet potatoes were all later than normal. But, because of an extra two inches of rain in March, and because temperatures remained high in the latter part of the season, yields were generally higher than last year, except in the case of velvet beans for seed.

Late blight *(Phytophthora infestans)* was first recorded on the potato crop on January 10th but, as the latter half of January was dry, did not assume serious proportions until February. The yield of susceptible varieties was reduced considerably. Incidence of the leaf blight, *Helminthosporium turcicum*, was generally light. In one of the inbred maize nurseries several plants became affected by the streak virus, *Fractilinea maidis*, and had to be removed. During the winter certain varieties of wheat contained a considerable proportion of stunted plants, symptoms which correspond to those recorded in the literature for *Fractilinea maidis*. It is feared that, with the regular planting of winter crops under irrigation, the incidence of streak is on the increase and its control may involve serious measures.

CROP ROTATION TRIALS

In 1954 a new series of these trials was laid down with the primary object of measuring the effect, both on the soil and on maize yields, of regular applications of nitrogen. This new series covers systems in which the maize stover is removed, and systems in which it is ploughed back. It also covers systems in which maize is grown every year and systems in which a rotation crop is introduced. Five seasons' results are now available and they are tabulated.

YIELDS OF MAIZE (in bags of 200 lb. per acre)

Season	System							
	S1	S2	T1	T2	W	X	Y	H
1954/55 .	26·05	28·43	23·78	24·90	25·54	22·51	21·08	20·19
1955/56 .	20·60	22·75	19·55	20·20	G.M.	G.M.	G.M.	15·80
1956/57 .	15·85	20·30	16·00	17·60	22·00	21·75	20·53	18·85
1957/58 .	10·10	10·70	13·95	15·40	16·13	17·15	16·68	16·65
1958/59 .	15·75	17·80	17·28	19·73	G.M.	G.M.	18·47	16·32

In systems S1, S2, T1 and T2 maize is planted annually with the stover removed in the S and ploughed back in the T systems. S1 and T1 receive 50 lb. of N per annum whilst S2 and T2 receive double that amount. Systems W and X consist of a green manure crop followed by two crops of maize, the stover being removed in W and ploughed back in X. System Y consists of a green manure crop followed by four crops of maize and the stover is ploughed back. Systems W and X receive 100 lb. N in a three-year period; system Y receives 300 lb. N in a five-year period. System H, green manure and maize alternately, receives no nitrogen at all and was established in 1946.

Although this latest series of classical plots has not been in progress long enough to see the yield level each is capable of maintaining, the yield trend is downwards. It will be seen that, so far, the downward trend is less marked where the stover is ploughed back. The particularly low yields in 1957-58 can be attributed to the poor season, late planting and lack of rain in March.

STUBBLE MULCHING AND TRASH FARMING

The object of this investigation is to compare methods of using the stover or crop residues on a farm on which maize is the most widely grown crop. In the season under review the crop grown was soya beans. Previously four successive

crops of maize had been grown and the resulting yields are tabulated for these maize crops, as well as for the soya beans grown in 1958-59.

Stover Treatments;

A=Control. Stalks cut at ground level and removed.

B=Stalks ploughed back (trash farming).

C=Stalks chopped and left on the surface as a stubble mulch.

D=Stalks removed and a dressing of 2 tons of kraal compost per acre ploughed back.

YIELDS OF GRAIN (in bags of 200 lb. per acre)

Crop and Season	A	B	C	D	Mean
Soya Beans, 1958/59	6·72	7·83	7·87	7·41	7·46
Maize, Mean of four Seasons .	21·97	23·37	20·57	23·85	22·44

In the case of both maize and soya beans the ploughing back of the stover has proved beneficial to yield when compared with the control treatment; and the cumulative effect, as the trial proceeds, is resulting in the superiority of treatment B becoming more marked. It is interesting to see that the stubble mulch treatment (C), whilst it has given lower yields of maize, has given yields of soya beans equal to treatment B. Evidence is accumulating that the practice of ploughing back the maize stover, unless the stover is completely covered, is resulting in the increased incidence of cob rots. It is thought that other agronomic practices, such as early planting and the tendency towards monoculture instead of rotation of crops, may also be having an influence on cob rot incidence.

MAIZE BREEDING

The Station's report includes a table showing the comparative yields in bags per acre, and the total maize produced, from hybrid and open-pollinated seed on European-owned farms in Southern Rhodesia since hybrids were first used in the 1949-50 season. The yield differences are striking and the table also shows the steady increase in the percentage of the total acreage planted to hybrids, from 22 per cent. in 1949-50 to 83 per cent. in 1957-58.

During the first ten years eleven hybrids have been produced for commercial planting. The maturity rating of all these hybrids is very similar; they mature approximately fourteen days earlier than the open-pollinated varieties, Hickory King and Southern Cross. A limited quantity of S. R. Hybrid No. 12 has been put on the market for the 1959-60 season. This variety is later maturing than any of the previous eleven, but is still a couple of days earlier than the two open-pollinated varieties mentioned. It is expected to have better resistance to *Helminthosporium* than its predecessors.

Results in station trials for some while have indicated that a number of single hybrids developed in recent years are capable of considerably higher yields than any of the double hybrids tested so far. The single hybrid 58 H 6 (SC 5522 x SW 55167), the pollen parent of S.R. Hybrid No. 12, gave very high yields in seed production plots on farms this year and, as a result, there have been many inquiries from farmers asking if seed of this single hybrid is for sale. It has been decided to produce limited quantities of seed of high yielding single hybrids for the commercial market. It remains to be seen whether the increased yields from these hybrids will be sufficient to compensate for the higher cost of the seed.

MAIZE—POPULATION X FERTILITY TRIAL

The object of this trial is to compare the yield of grain obtained at four population rates and to see if there is any interaction between population and fertility level, the fertility level being regulated by the amount of nitrogen applied.

MEAN YIELD OF GRAIN (in bags of 200 lb. per acre)
SEASONS 1956/1959

Nitrogen	3′ x 18″	3′ x 15″	3′ x 12″	3′ x 9″	Mean
0	26·20	29·12	32·17	30·20	29·42
250 lb. S/A	28·40	31·32	33·27	35·46	32·11
500 lb. S/A	28·38	32·64	34·64	33·58	32·31
MEAN	27·66	31·03	33·36	33·08	

Over the three seasons the 3 feet x 12 inches spacing (14,520 plants per acre) has given the highest yield. It is possible that in an unfavourable season results might be somewhat different. Counts of lodged plants have revealed a similar picture each year and the figures given are the means for the three seasons.

PERCENTAGE OF LODGED PLANTS

3′ x 18″	3′ x 15″	3′x 12″	3′ x 9″
3·7	5·3	11·5	23·0

MAIZE—APPLICATIONS OF NITROGENOUS FERTILIZERS

The season was favourable for large responses to nitrogen. The three forms of nitrogen being tested gave very similar results and the response to nitrogen applied at planting was greater than to nitrogen applied as a top-dressing six weeks after planting.

YIELDS OF GRAIN (in bags of 200 lb. per acre)

	0 lb. N	33⅓ lb. N	66⅔ lb. N	100 lb. N	Mean
All at planting		22·46	25·91	27·08	25·15
All top-dressed at 6 weeks		21·70	23·85	25·31	23·62
Half and half		21·61	25·18	27·96	24·91
Mean	16·09	21·92	24·98	26·78	
Sulphate of Ammonia		21·69	26·06	27·26	25·00
Urea		22·36	24·80	25·28	24·15
Ammonium Nitrate		21·71	24·08	27·82	24·54
Mean	16·09	21·92	24·98	26·78	

The results in the trial to measure the residual effect of applications of nitrogen made in one year on maize planted the next were very similar to those of last year. Heavier applications of nitrogen in 1957-58 increased the yields of maize in that season, but led to reduced yields in 1958-59. The most likely explanation is that some plant nutrient, other than nitrogen, was removed in greater quantity in the high nitrogen plots in 1957-58 and has limited yields in 1958-59.

WHEAT

By growing both winter and summer crops, and so completing two generations a year, good progress has been made in the wheat breeding programme since the appointment of the Wheat Breeder in 1955. For the first time wheats developed from crosses made by the Wheat Breeder since his arrival in Salisbury were included in replicated yield trials this winter. Final results of this crop are not yet available, but a wheat developed from a cross between the Australian variety, Federation, and an Angola variety, has yielded approximately 24 bags an acre. In the same trial, conducted at a high fertility level, the weak-strawed standard variety Punjab lodged badly and yielded 13.1 bags per acre. This result is most encouraging.

Summer yields averaged from eight to nine bags an acre. The difference in yields obtainable in the summer and winter must be attributed to some extent to the unsuitability of the hot summer growing season for wheat production, as the summer plots were kept reasonably free from weeds by hand cultivation and many of the varieties being grown remained almost free from stem rust.

POTATOES

Potato experiments, especially the earlier planted ones, were severely affected by the season. The late arrival of the rains and the high soil temperatures prevailing resulted in seed tubers degenerating in the ground and in two plot trials stands were so poor that no valid analysis of the results could be made. Yields were considerably lower than in previous years and this is attributed to prolonged dry periods during the growing period. In spite of dry periods, however, late blight *(Phytophthora infestans)* considerably reduced the yields of susceptible varieties.

1. VARIETIES

The varieties Walanga and Loman 43-35 again gave good yields, showing a high degree of field resistance to late blight, while Ulster Prince confirmed its reputation for early maturity. Yields from Pimpernel were disappointing.

Of the other varieties tried out, none showed exceptional promise compared with Loman 43-35 and Walanga. B.P.1., however, although not resistant to late blight, gave indications of providing an alternative to Up-to-Date.

Seedling R 571/1 yielded moderately well and again appeared quite resistant to late blight, while R 639/33 was exceptionally resistant. In view of the recent demand for white-fleshed varieties these two seedlings may prove valuable.

2. OTHER EXPERIMENTS

(a) *Fertilizer Trial.* Poor stands made an analysis of yields impracticable, but data on the percentage dry matter in the tubers was analysed. Effects of treatments were not statistically significant but trends indicated that increased applications of nitrogen increased the dry matter content of the tubers, while increased applications of kraal manure had the opposite effect.

(b) *Seed Rate Experiment.* Irregular stands completely altered the seed rate treatments and made any estimate of the effect of seed rate on yield impossible.

(c) *Mulching and Ridging.* In the second year of this experiment to determine the effects of reducing soil temperatures and moisture loss by mulching and growing the crop "on the flat", no significant effects due to any treatment were recorded.

GENERAL

To mark the occasion of the fiftieth anniversary of the station, a Farmers' Day was held on 20th March. The Minister of Agriculture, Mr. J. C. Graylin, addressed the gathering and recounted some of the more important work carried out on the station during the fifty years. Major H. G. Mundy gave an interesting talk on the early history of the station. A potato field-day was held in February. The Station was open to visitors throughout the year and a large number came for advice and to see the trials and investigations in progress. Dr. G. D. H. Bell, Director of the Plant Breeding Institute, Cambridge, visited Salisbury in October, 1958, and was able to spend some while discussing plant breeding problems, an opportunity which was very much appreciated by the staff of the Station.

As the production of hybrid varieties of maize for commercial planting is based on results from the Station's breeding programme, the organization of the bulking of seed of inbred lines and parent single hybrids has taken place from this Station, which has supervised the roguing of parent seed plots both at Panmure Hybrid Maize Farm and on farms doing the work under contract. As a wider range of hybrids are put on the market, and particularly if the use of single hybrid seed becomes popular, it will become increasingly difficult for the staff of this Station to supervise this work in addition to their normal duties.

Whilst on overseas leave Mr. Montague visited research stations in the United Kingdom and Holland and studied the latest developments both in breeding and the production and marketing of seed and commercial potatoes. He spent several days at the Plant Breeding Institute, Cambridge, and as a result arrangements have been made for some of the most promising of the seedling material from this Institute to be sent to Salisbury for trial in this country. Mr. Montague visited Pretoria in January to see the potato breeding work being carried out by Dr. J. E. van der Plank in the Union of South Africa.

The Officer-in-Charge of the Station served on the Executive Committee of the Seed Maize Association, the Interim Fibre Committee, the Field Experimentation Committee, the Fertilizer Advisory Committee and the Committee for the Maize and Agricultural Produce Sections of the Rhodesian Agricultural Horticultural Society. He assisted in the judging of the maize and produce sections of the Bindura, Gatooma and Salisbury Agricultural Shows. The Potato Breeder attended meetings of the Rhodesia Seed Potato Association and the Farmers' Co-op. Potato Pool in an advisory capacity and is a member and acts as secretary of the Departmental Potato Committee.

PUBLICATIONS

A. G. H. Rattray:

1. "The Soya Bean in Rhodesia". Paper presented to the 1959 Conference of the Professional Officers of the Department. To be published in bulletin form.
2. "Groundnut Production in Southern Rhodesia". Article written for the *Rhodesian Farmer* of November 21st, 1958, in conjunction with W. E. Kerr and H. C. Ducker.

V. J. Montague:

1. "Advisory Leaflet for Potato Farmers", September, 1958.

GATOOMA RESEARCH STATION

A. H. McKINSTRY
Officer-in-Charge

INTRODUCTION

Total cotton production in 1958-59 was approximately 840 bales of lint, which is an increase of about 100 bales on the previous season's crop. Irrigated cotton in the Sabi Valley accounted for the increase.

Inquiries for advice on cotton growing practices, and an increase in the demand for cotton seed for planting, indicate that there will be, probably, a further limited increase in acreage planted to the crop in the 1959-60 season.

In regard to yields, reports from different areas indicate that climatically, the 1958-59 season was a favourable one for cotton growing. There have been instances of small acreages in the rain-grown commercial crop yielding 1,200 to 1,600 lb. seed cotton per acre, where insecticides have been applied to well-managed crops. Similarly, yields of about 2,000 lb. of seed cotton per acre have been obtained from the irrigated crop in the Sabi Valley. In experiments, the overall mean yield of seven rain-grown variety trials was 1,292 lb. seed cotton per acre, and a mean of 3,045 lb. was obtained from two irrigated trials. Endrin insecticide was applied, as recommended to growers, in all trials.

Results from certain experiments with crops other than cotton are also given in this report.

RAINFALL AT GATOOMA

The total rainfall for the season, October, 1958, to April, 1959, inclusive, at the Station's "Laboratory" guage, was 23.93 inches. Distribution was erratic. Part of the maize acreage was planted towards the end of October and the main cotton experiments were sown towards the end of the first week of November, 1958, but the remainder of the planting of all crops did not take place until after the 5th December when a rainstorm of 1.75 to 2.25 inches fell. Thereafter, rainfall distribution varied from good to fairly good until towards the end of February. Rains, however, ended for all practical purposes in February, as only approximately 0.5 inch was recorded in a number of smaller showers in March, 1959.

During the first thirteen days of January, sunshine registered a mean of only three hours per day, which is low.

Further details of rainfall and sunshine records are shown in the following table:

RAINFALL AND SUNSHINE RECORDS
FOR THE PERIOD OCTOBER, 1958 TO APRIL, 1959, INCLUSIVE
(Figures in brackets are for 1957/58)

Month	*Total rainfall (inches)*	*Rainless days (omitting traces of rain)*	*Longest period without rain*	*Mean sunshine hours per day*
October, 1958 . . .	3·24 (2·94)	21	11	7·29 (7·7)
November, 1958 . .	1·49 (1·96)	18	5	7·73 (7·5)
December, 1958 . .	9·46 (3·69)	12	5	6·06 (6·2)
January, 1959 . . .	5·36 (10·87)	16	7	6·79 (4·9)
February, 1959 . . .	3·83 (10·14)	15	5	5·98 (3·3)
March, 1959 . . .	0·50 (1·60)	25	13	7·49 (9·3)
April, 1959	0·05 (1·19)	29	21	9·25 (8·5)
	23·93 (32·39)			

COTTON PLANT BREEDING

Mr. F. E. M. Gillham continued to be responsible for the cotton plant breeding programme, and the following information has been obtained from a report written by him:

The cotton plant breeding programmes for rain-grown and irrigated cotton continued at Gatooma and at Sabi Valley Experiment Station respectively. It is anticipated that certain trials, planned for the 1959-60 season, will give a final indication of whether there is need for two separate programmes. From the results so far, it appears that it will be necessary to continue with the separate programmes, and that a different source of genetic material, but probably still

within *G. hirsutum*, may also be needed in the Sabi Valley. To date, the same sources of *G. hirsutum* strains have been used in both programmes.

District Variety Trials. Once again, variety trials were conducted at ten centres in Southern Rhodesia and at five centres in Northern Rhodesia. In the Southern Rhodesian trials, where early planting was possible, outstanding yields were obtained, the overall mean of seven rain-grown trials being 1,292 lb. seed cotton per acre, and the mean of two irrigated trials was 3,045 lb. seed cotton per acre. No results are available from Northern Rhodesia at the time of writing.

Albar 637 maintained its promise in all but one of the Southern Rhodesia District Trials. On the strength of yield results, and the fact that Albar 637 also shows improvements over U4 strains in ginning percentage, lint quality and bacterial blight resistance, this variety is being issued in 1959-60 on a fairly wide scale. Albar 637 will, therefore probably replace the old U4 varieties completely in the 1960-61 season.

All District Variety Trials received eight weekly applications of Endrin at a rate of 0.25 lb. Endrin active ingredient in 10 gallons water per acre commencing at first buds. Control of insect pests was generally satisfactory and this fact facilitated comparison between varieties in the trials.

Insecticide Treatment of Plant Breeding Plots. At the Gatooma Research Station, the plant breeding material received four weekly applications of Endrin at 0.25 lb. per acre commencing on 29th December. From 27th January, 1 lb. DDT per acre was added to the 0.25 lb. Endrin for a further four weeks. The ninth application contained 2 lb. DDT and 0.5 lb. Endrin in 20 gallons water per acre, while the tenth and final application on 3rd March contained 0.5 lb. Endrin in 20 gallons per acre. Despite a heavy American bollworm attack, this liberal application of insecticide to the plant breeding plots, combined with early planting on 6th November, 1958, resulted in the highest yield ever obtained at the Gatooma Station. The mean yield in the District Variety Trial was 1,668 lb. per acre with a top yield of 1,847 lb. per acre for Albar 637.

Bacterial Blight. All seed of supposedly resistant material was soaked in a suspension of bacteria prior to planting, and later, at thinning, all infected plants were removed. Subsequently one boll on each of the remaining plants was inoculated, and only plants with very little lesion development, resulting from the inoculation, were selected. In addition, selection was based on natural development of the angular leaf spot form of the disease.

Indications are that a satisfactory level of resistance is being developed in new selections.

Selection Work. Selection continued in the same material as in the past, viz:

(1) Progenies of selections from various Albar 51 strains.

(2) Progenies of crosses between Albar 51 strains and strains derived from the cross MU8A x BP52[2] (these are termed BMA strains).

(3) Progenies of crosses between *G. barbadense* BAR 4/18 and various *G hirsutum* strains.

(4) Strains of BP 52, supposedly homozygous for B_2B_6, introduced from the Sudan.

(5) Progenies of crosses between Albar 51 strains and various derivatives of U4.

BMA and Albar derivatives were included in Small Bulk Trials at seven centres for the first time. Generally, they showed considerable promise of being improvements on U4 strains in yield, bacterial blight resistance and lint quality. The best strains have gone forward to District Variety Trials.

Further improvement in these strains was evident in the Replicated Progeny Trials at both Gatooma and Sabi Valley Experiment Stations. Top strains from these trials have been included in the 1959-60 Small Bulk Trials.

If the present promise and rate of progress is maintained, it is anticipated that Albar 637 will only be in cultivation for about three seasons before being replaced by one of the BMA derivatives.

Selections were taken from 3, 4 and 5 above and in the case of 3 and 5, modal bulks have been formed.

Hybridization was carried out for the first time in the new greenhouse at Gatooma during the winter of 1959. In order to increase boll size, to facilitate picking, the big-bolled American variety Arkot 2-1 was crossed with Albar 637 and MU8A. The aim is to develop a high yielding, high quality strain with satis-

factory bacterial blight and jassid resistance and a boll size giving 60-70 bolls per pound. This approach is made possible by improved methods of insect control which do away with, to some extent, the need for varieties like the U4 derivatives which produce large numbers of small bolls and so compensate partially for insect damage and loss.

U4 Strains. Selections were carried out in U4 material at both Gatooma and Sabi Valley Experiment Stations. The latest selections will be used to test if there is need for continuation of the two separate programmes. No further selection work in U4 material is planned.

COTTON INSECT PESTS CONTROL

Mr. E. O. Pearson, Director of the Commonwealth Institute of Entomology, London, visited the Federation from the 20th April to the 8th May, 1959, to examine and advise on the programme of investigations into cotton insect pest control, based on recommendations made by him in 1956.

The programme has been extended for a further period of three years, commencing in December, 1959.

The following information has been extracted from the Abridged Annual Report for the 1958-59 season, written by Mr. J. P. Tunstall and Mr. G. A. Matthews, Entomologists, responsible for cotton pests investigations at Gatooma.

Introduction. The basic investigations into the biology and control of cotton bollworms, together with toxicological work were continued at the Gatooma Research Station, while investigations into the biology of cotton stainers were continued at Makanga Experiment Station, Southern Province, Nyasaland. Insecticide trials, together with certain of the associated biological studies, based on work at Gatooma, have been extended to the Chitala Station, Central Province, Nyasaland, and to the Sabi Valley Experiment Station, Southern Rhodesia.

Biological Investigations on Diparopsis castanea Hmps. Detailed observations on the behaviour and natural mortality of the various stages in the life cycle of D. *castanea* (red bollworm), made under both laboratory and field conditions have included the following:

Eggs. The proportion of eggs lost remained high throughout the season, amounting from 80 to 100 per cent. over certain periods. Towards the end of the season continuous observations on 397 eggs showed that ants, in particular *Pheidole megacephala* F., accounted for the loss of 34 per cent. of these eggs. Thirty-five per cent. of the eggs were lost through no obvious cause, although heavy losses following rain suggest that loss of adhesion is influenced by the wetting of the eggs. The remainder of the egs, or 31 per cent., were recorded as having hatched. The mean incubation period in the field was nine days (range 6-13 days), and the time of hatching was between 04.00 and 08.00 hours.

Larvae. First instar larvae of *Diparopsis* will penetrate buds, flowers, and green bolls of all ages, and in their absence early in the season, the larvae will attack the terminal growing points of plants.

The mean time taken by *first instar* larvae to reach the site of penetration was 115 minutes (range 15 to 310 mins.) and furthermore, a mean of 126 minutes (range 3 to 140 mins.) was taken to penetrate the plant. Mortality over the period hatching to penetration was 30 per cent., most of which was caused by larvae ceasing to move and dying for no apparent reason.

By continuous observation of the fate of 90 eggs which hatched between the 12th and 15th March, it was established that mortality from the time of larval penetration of the plant to moth emergence was 98 per cent., ants accounting for at least 69 per cent. of the loss.

Observations on 37 *fifth instar* larvae showed that a mean period of 21 minutes (range 0 to 150 mins.) was spent in movement and resting on the plant while a mean period of 26 minutes (range 0 to 115 mins.) was occupied in wandering on the ground. Thereafter the mean time taken to penetrate the soil was 34 minutes (range 15 to 125 mins.). Approximately 88 per cent. of the fully grown larvae left the plant between 19.00 and 01.00 hours. No larvae were observed to pupate between 04.00 and 18.00 hours. In fact all main movements of larvae occured at night. The total length of the larval period in March/April averaged 38 days.

Pupae. Pupation sites in the ground were fairly evenly distributed between the rows with the depth of pupation varying from half to six inches. The period occupied by short-term pupae was approximately 21 days.

On the basis of a mean egg incubation period of nine days, a mean larval period of 38 days and a short-term pupal period of 21 days, the total mean life cycle of *Diparopsis* during the *March/April* observations is approximately 10 weeks. It is unlikely, therefore, that more than two generations of *Diparopsis castanea* are produced during the main period of crop development at Gatooma. This information emphasises the importance of achieving a good control of the initial invasion of cotton crops by *Diparopsis* originating from overwintering pupae.

Further Pupation and Moth Emergence Studies. (a) The majority of larvae collected from *ratooned cotton* in October/November, 1958, produced short-termed pupae, which gave rise to moths over a period of some 15 weeks at the start of the season. Thus the fact that the presence of ratooned cotton can result in an early build-up of *Diparopsis* is again confirmed.

(b) Under conditions in the *pupation gardens* the proportion of long-termed (over-wintering) pupae produced increased from a small number in February to 100 per cent. by May, 1958, thus confirming the results of previous seasons. Moth emergence from the over-wintering pupae extended from October, 1958, to March, 1959, with a distinct peak emergence during late December, 1958, and January, 1959.

(c) *In field cages*, set in a 1957-58 cotton land (unploughed but with plants destroyed) moth emergence which extended from October, 1958, to March, 1959, was of the order of 3,600 moths per acre despite a pupal mortality of 52 per cent.

(d) Pupae collected in the field during August and September, 1958, were set in the pupation gardens at depths of a half inch, one inch, two inches, three inches four inches, six inches and eight inches. The length of the moth emergence period —approximately 16 weeks—was hardly affected by depth, but the date on which moth emergence commenced was considerably modified. Thus pupae set at the shallower depths gave rise to a late emergence, while the majority of pupae set at six inches to eight inches had emerged by the end of December, 1958. It is, therefore, possible that with certain soils an effective inversion of the top six inches to eight inches would modify the emergence period.

Chemical Control. The toxicity of various insecticides to insect pests of cotton is being investigated in the laboratory by bio-assay techniques. The number of experiments has been restricted by difficulties encountered in rearing the insects in sufficiently large numbers for statistically valid assays.

However, *Diparopsis* and *Heliothis armigera*, Hb. (American bollworm) cultures are now being maintained. It is hoped also that further controlled conditions, which are being provided, will result in the breeding of large numbers of *Dysdercus* spp. (cotton stainers).

The following results have been obtained, so far:

First instar larvae of *Diparopsis* can be killed as they eat their way out of eggs by insecticides deposited on the eggs. Having observed this fact, eggs were dipped in different insecticides with the following results:

Provisional LD 50 for insecticides tested against Diparopsis 1st instar larvae:

Insecticide	*Concentration*
Sevin	0·002–0·004%
Endrin	0·008–0·03%
B.H.C.	0·014%
Rogor	0·023%
Aldrin	0·032%
Dieldrin	0·051%
Malathion	0·145%
DDT	0·17–0·24%

Individual cotton buds were sprayed to run-off with different insecticides and infested individually with a single *Diparopsis* egg. Initial results, based on the number of first instar larvae which penetrate the buds, indicate that the relative toxicity is comparable to the egg-dipping technique.

Results to date indicate that Sevin is very toxic to the first instar larvae of *Diparopsis*. On the other hand, toxicity tests with *Heliothis* indicate that DDT is more toxic to this bollworm than Sevin.

As both Sevin and DDT are much less toxic to humans than Endrin, further field experiments comparing these three insecticides have been planned for 1959-60.

In an experiment to assess the *persistence* of insecticides in the field, judged on the penetration of first instar *Diparopsis* larvae, it was shown that DDT emulsion was more persistent than Endrin emulsion or Sevin wettable powder.

Field Trials. (a) Four sprayed and four unsprayed three-acre plots were arranged in pairs, one pair being on the Station while three pairs were on different farms in the Gatooma area. The plots were planted to Albar 637, a variety which has a high degree of resistance to bacterial blight. Three of the sprayed plots received eight applications of Endrin at the rate of 0.25 lb. active ingredient in 10 gallons of water per acre at weekly intervals from first flower buds. The fourth sprayed plot received, in error, only five applications of Endrin at fortnightly intervals.

The yield of the plot which was sprayed five times was 565 lb. seed cotton per acre compared with yields of 1,158, 1,044 and 949 lb. seed cotton per acre from the the three plots which received eight applications of Endrin.

Futhermore, the mean yield of the plots which received eight applications of Endrin was 1,050 lb. compared with a mean yield of 664 lb. from the corresponding three unsprayed plots.

The 1958-59 season was favourable to the development of cotton but there was, nevertheless, a statistically significant increase in yield due to spraying in the four pairs of plots.

Tagging of white flowers daily on the pair of plots at the Gatooma Station showed that 22.4 per cent. of the tagged flowers developed into clean bolls on the sprayed plot compared with only 8.6 per cent. on the unsprayed plot.

In regard to insect pests, the *Diparopsis* population was higher than in the previous season. Also, a heavy *Heliothis* attack occurred on the sprayed plots during the peak flowering period, and this attack was not controlled by Endrin spraying. Indeed, maximum shedding coincided with the *Heliothis* attack, and rather more of the sheds on the sprayed plots were damaged by bollworms than on the unsprayed plots. Finally, *Earias* spp. (spiny bollworm) and *Dysdercus* spp. populations were again low.

(b) In another field, trial comparisons were made between Endrin emulsion (three treatments) DDT emulsion (one treatment) and Sevin wettable powder (two treatments). Eight applications of the insecticides were made over a period of nine weeks.

The yield of the DDT treatment, namely 1,822 lb. seed cotton per acre, was significantly higher than the three Endrin treatments (i.e. 1,357 lb., 1,395 lb. and 1,488 lb.) and than the two Sevin wettable powder treatments (i.e. 1,023 and 1,128 lb.). The lower yield from a Sevin treatment was significantly less than any of the three Endrin treatments.

The high yield of the DDT treatment taken in conjunction with the entomological data was probably due to better control of *Heliothis*.

Although Sevin in the form of wettable powder gave the lowest yields, the Entomological data together with laboratory experiments indicate strongly that Sevin is superior to Endrin and DDT for *Diparopsis* control.

AGRONOMY

Mr. J. M. Colyer joined the staff of the Gatooma Station on 1st November, 1958, on first appointment. Much of the following information has been extracted from a report written by him.

COTTON

Spacing Fertilizer Trial Treatments were as follows:

	Nutrient levels: lb./acre		
	0	1	2
N as Sulphate of Ammonia	0	20	40
P_2O_5 as Superphosphate	0	30	60
K_2O as Muriate of Potash	0	30	60
Spacing between plants in the row	9″	12″	18″

Spacing between rows was 3·5′ in all plots.

The trial received 11 applications of insecticides. However, yields were disappointing; this was probably due to somewhat unfavourable growth conditions which included waterlogging and possible nitrogen deficiency, rather than to losses by insect pests.

The mean yield of the trial was 823 lb. seed cotton per acre.

The highest yield, namely 1,125 lb. seed cotton per acre was obtained from the 9-inch spacing to which 40 lb. N and 60 lb. P_2O_5 per acre had been applied. The

lowest yield, 488 lb. seed cotton per acre was obtained from the 18-inch spacing to which no N and only 30 lb. K_2O per acre had been applied. For various reasons it has not been possible to analyse the trial statistically.

Cotton Weed-Control. As a result of preliminary observations made on the effect of certain herbicides on the development of weeds and young cotton plants, grown in observation plots in 1958-59, further more detailed experiments have been planned for 1959-60. As pre-emergence sprays "Isodiazine" (S. triazine group), "Diuron" (substituted urea group), "Hoe 2764" (dinitrophenol group) will be tested, and a non-fortified herbicidal oil will be applied as a post-emergent spray.

Cotton Harvesting Methods. The weight of seed cotton harvested by hand is only about 50 to 80 lb. per picker per day in Rhodesia compared with double these quantities obtained in the U.S.A. Therefore, work was started at Gatooma, in 1959, on the problem of increasing the quantity and quality of cotton picked by hand Three aspects of the problem are being considered:

(a) Method study and work measurements.

(b) The use of picking "aids" in conjunction with (a).

(c) Cotton defoliation.

Results obtained point the way to certain refinements which will be applied in further investigations in 1960.

Investigations concerned with cotton picking and also with weed control problems will not result in increased yields of seed cotton per acre, but they are likely to lead to greater efficiency in the production of the crop and, therefore, possibly to an increase of acreage and to the total quantity of cotton produced.

CROPS OTHER THAN COTTON

Kenaf (Hibiscus cannabinus). A collection of 115 strains of kenaf, obtained from 27 countries, including the U.S.A. and the U.S.S.R., were planted at Gatooma on the 8th December, 1958. Several promising strains, uniform for plant type and flowering habit, and originating mainly from the U.S.A. and Cuba have been selected for comparison in widespread trials in Southern and Northern Rhodesia in 1959-60. Further plant breeding work is being continued at Gatooma. In particular, in addition to trials, seed multiplication of promising varieties and single plant selections, certain crosses were made in the greenhouse in the winter of 1959, and a small eelworm garden in which the tolerance of different varieties to the pest will be assessed, has been established.

Kenaf Spacing Fertilizer Trial. Treatments in this trial were as follows:

	Nutrient levels: lb./acre		
	0	1	2
N as Sulphate of Ammonia	0	40	80
P_2O_5 as Superphosphate	0	30	60
K_2O as Muriate of Potash	0	30	60
Spacing between rows	6″	12″	18″

Spacing between plants in the rows for all treatments, 2″ approximately.

Seed of a commercial variety, which turned out to be very heterozygous for plant type and date of flowering, was planted.

The trial, planted on the 11th November, germinated mainly after 5th December, 1958, the delay being due to lack of rainfall.

Despite the heterozygous condition of the "variety", and a comparatively short growing period before the onset of flowering, combined with poor rainfall, which contributed to the low mean height of only just over five feet, the following results were obtained:

(a) The mean green-weight yield for all treatments was 7.1 tons per acre. The 6-inch spacing yielded 7.9 tons per acre which was superior to the 12-inch spacing by 0.7 tons per acre and to the 18-inch spacing by 1.7 tons per acre.

(b) Green weight measurements also showed that applications of nitrogen and phosphorus increased yields, but potassium did not.

(c) The overall mean yield of "ribbons" was 671 lb. per acre or 0.335 tons per acre, which after conversion gave an approximate fibre percentage of 4.71 per cent., a low average figure due to poor plant growth.

(d) "Ribbons" yield for the 6-inch spacing was 850 lb. per acre or 0.425 tons per acre, which was superior to the 12-inch and 18-inch spacings by 175 lb. and 460 lb. respectively.

(e) Based on "ribbon" yield, fertilizer treatments did not increase the fibre weight in the same proportion as they did for green weight, although small increases were noted with nitrogen and phosphorus.

The yield results as a whole are approximately a half of those which would be expected with early planting, a suitable variety, and sufficient rainfall throughout the season.

Maize Stubble Mulch Trial. This trial, started in 1955-56, was terminated in 1958-59, having completed four seasons. The trial was designed primarily to test the effects of the three cultivation treatments: simulated "stubble mulch", "trash ploughed under" and "trash removed" (clean ploughed on the incidence of *Helminthosporium*, various cob rots and maize stalk-borer damage. Each of the three cultivation treatments received applications of 0 lb., 200 lb. and 400 lb. per acre of sulphate of ammonia, half of the fertilizer being applied at planting and half at knee-height. Plant spacing throughout the existence of the trial was 3 feet between rows, and 1.5 feet between plants in the row, with one plant left per planting station on thinning. Grain yields in terms of bags (200 lb.) per acre are given in the following Table:

Treatments		Maize Grain Yields in Bags per acre			
		1955/56	1956/57	1957/58	1958/59
Clean	N_0	9·9	5·2	8·8	13·7
	N_1	15·6	12·0	15·3	17·2
	N_2	18·4	16·7	17·6	19·9
	Means	14·6	11·3	13·9	16·9
Trash	N_0	8·0	4·6	8·5	12·4
	N_1	12·6	11·0	14·4	15·9
	N_2	16·3	14·9	16·3	18·2
	Means	12·3	10·2	13·1	15·4
Stubble	N_0	6·2	4·6	6·0	8·3
	N_1	12·6	10·5	12·0	13·1
	N_2	12·6	13·9	15·1	15·3
	Means	10·5	9·7	11·0	12·2
Rainfall "W.E.G." in inches		45·42	22·79	32·56	22·63

Statistical analysis of the 1958-59 yields confirmed that of the previous three seasons, namely, the apparent superiority of removing all maize residues compared with ploughing them under or leaving them on the surface. It must be pointed out, however, that a count of the number of cob-bearing plants expressed as a percentage of the potential stand showed that the mean percentage of plants with cobs in the "clean" plots was 90.2 per cent. as contrasted with 86 per cent. in the "trash" plots and 80.9 per cent. in the "stubble" plots, all differences being significant. Similarly, differences between sulphate of ammonia applications were significant, the relevant percentages being $N_0=80.3$, $N_1=86.8$ and $N_2=89.7$. These differences between cultivation and between fertilizer treatments could account for, in part at least, the recorded differences in yield. The differences are probably related to the fact that the seed-bed for germination and seedling development appeared to be most favourable in the "clean" plots and least so in the "stubble" plots.

At harvest an analysis of 200 cobs from each plot for disease and insect damage, by the Officer-in-Charge, Seed Services, confirmed those of previous years, namely, that with increasing levels of sulphate of ammonia the prevalence of *Diplodia zeae* was decreased and furthermore that the amount of insect attack and secondary infection from *Fusarium moniliforme* tended to increase with increasing levels of the fertilizer.

Results and observations obtained from the "Maize Stubble Mulch Trial" over a period of four seasons, have proved of great value in clarifying certain problems, and in the planning of further trials which will commence in 1959-60.

Pigeon Peas or Dhal (Cajanus cajan). Seed stocks were renewed from the collections of varieties, grown in observation plots, which were planted in December,

1957. Seed was issued, and in some instances reissued, to several centres in the Federation, mainly to Conservation and Extension Department Officers. There appears to be an increasing interest in the legume for animal grazing purposes.

CROP TRIALS FOR OTHER STATIONS

The trials listed below were planted, maintained, and harvested at Gatooma, on behalf of Professional Officers who are responsible for the main experimental work on the different crops, as indicated, at other Research Stations. Details of treatments, the experimental designs used, and the analyses of yield results, are for report by the officers concerned.

The 1958-59 trials grown at Gatooma were:

1. White maize varieties trial for Salisbury.
2. Wheat varieties trial for Salisbury.
3. Groundnut varieties/times of planting trial for Salisbury.
4. Lucerne varieties irrigated trial for Salisbury.
5. White and yellow maize varieties trial for Matopos.
6. Sorghum varieties trial for Matopos.
7. Castor bean varieties/fertilizers trial for Matopos.

GRASSLANDS RESEARCH STATION

H. D. L. CORBY
Officer-in-Charge

The Grasslands Research Station, at Marandellas, serves the agriculture of some 12½ million acres of sandy country in north-eastern Southern Rhodesia, where the rainfall is usually sufficient and sufficiently reliable for arable farming without irrigation.

Within its means, the Station deals with all aspects of the agriculture of its region except tobacco, and there it works by offering its facilities and co-operation to the Tobacco Research Board of Rhodesia and Nyasaland.

As its main task the Station is seeking means of maintaining and raising soil productivity. It is believed that the sandy soils of the region, once brought into cultivation, can best be preserved for continuing agricultural use by some system of ley farming, and much of the work of the Station derives from this belief. At present, however, most of the arable land is still virgin and provides some of the best natural grazing in the country; some study, therefore, is made of the management of natural grassland. There is some work, too, with irrigated pasturage, and with vlei land, to provide green feed for the long dry winters.

The Station covers some 6,700 acres and has a staff of 27, of whom 14 are European and 13 African.

WEATHER

The rainy season was short and the rain ill-distributed, and most crops and experiments suffered accordingly. Livestock, on the other hand, did well until September, when, as a result of the poor rains, the vlei grazing failed to make its usual growth. Rainfall for the year was 6.25 inches below average at 29.89 inches. The winter was mild, with only 23 light ground frosts.

EXPERIMENTAL WORK

Grasses. Grasses, as the basis of the Station's work with ley farming, receive much attention, and the study of their culture and use has been continued.

In the hope of providing a sound basis for grassland management a series of experiments with effects of management on growth, yield and vigour is in progress, the general technique being to treat grasses in various ways and then to assess effects of treatment on the roots and on the "recovery-growth" in the following season. This year it has been shown that the root growth in Sabi Panicum is inhibited by frequent and/or untimely cutting and that, as a consequence, recovery-growth in the following season is correspondingly affected. Similar work is in progress with Star Grass.

In assessing the productivity of pastures in terms of beef it has been found, with a pasture of Kazungula Setaria and for the third season running, that increased output resulting from the use of nitrogenous fertilizers comes almost entirely from increased carrying capacity and hardly at all from increased gain per animal.

In a comparison of four grasses for use as winter foggage, steers gained an average of 50 lb. each on Sabi Panicum and Kazungula Setaria during the four months from June to September, while corresponding steers lost 37 lb. each on Katambora Rhodes Grass. On Ermelo Love Grass others lost 80 lb. each and had to be withdrawn from the experiment a fortnight earlier than those on the other grasses.

A comparison of Nile, Kikuyu, Tanner and Couch grasses for use in grassing dam spillways suggests that Nile Grass is the best of the four.

In the Nursery the "Shamva" selection of a species of *Digitaria* has been bulked for field trial; it seeds moderately well and is so profusely stoloniferous that it quickly forms a dense sward. Among recent introductions a fine, short, leafy Setaria is worthy of mention. Some ninety other grasses have been under observation during the year.

Legumes. A laboratory for studying the legume bacteria was established in August, 1958, and most of the past year has been given to developing techniques and gathering bacteriological material. Some 1,700 isolations have been made and nearly 1,150 of these have been confirmed as being of the genus Rhizobium. In

addition some 115 strains have been imported from other parts of the world. A light-room and a greenhouse have been added to the facilities of the laboratory.

Experiments with groundnuts have sustained last year's finding that only early-maturing varieties are suitable for local conditions, and have shown further that early planting is of importance, and that much remains to be done before crops of "confectionery nuts" can be produced.

Fifty-two varieties of lucerne, 127 of groundnut, 81 of soya bean, 182 of pigeon pea, and 50 miscellaneous legumes have been either tested or grown for observation during the year, and a search for eelworm-resistant clovers has been started.

In co-operation with the Rhodesian Wattle Company, study of effects of fertilizers on wattle has been continued.

Other Crops. Experiments with maize, the only crop except tobacco at all widely grown on sandveld soils, were continued during the year. As in past years, no substantial difference could be found amongst various forms of nitrogenous fertilizer in their use for maize, even the slow-acting "ureaform" appearing similar to the rest.

Test of herbicides for controlling weeds in maize were continued in co-operation with Messrs. African Explosives and Chemical Industries (Rhodesia) Limited, and Messrs. Fisons Pest Control (Central Africa) Limited. It is clear that certain herbicides are effective in certain circumstances; it is equally clear, however, that none of those so far tried is sufficiently versatile that it may be recommended for general use.

In comparisons of potatoes, the Australian variety *Walanga* has shown up well in quality, blight-resistance and yield; its yield, in a poor season, amounting to 16,800 lb. of tubers per acre.

In an experiment with Giant Japanese Radish, which may have a place as a winter feed for sheep, triple superphosphate, limestone and borax, all in greater or lesser degree, brought about a general increase in yield; nitrolime, on the other hand, increased the yield of the tops but decreased that of the roots. The average yield of tops and roots was 2,130 lb. of dry matter per acre.

Livestock. Much of the work with livestock lies in assessing pasture production, and is mentioned or implied elsewhere in this Report.

Facilities for assessing the digestibility of local roughages have been provided during the year, and the first tests were started in July, using caged sheep.

Study of the effect of nutrition on infertility in ranch cows has been continued in co-operation with the Department of Veterinary Research. With most of the cows now well into their third pregnancy, it would seem that there is, in animals running on natural veld grazing here, no infertility of nutritional origin.

In studies of the use of urea as a protein substitute in feeding yearling steers it would seem that it has a limited part to play, and that much remains to be done before its role may be clearly defined.

First results suggest that it is practicable to secure two crops of lambs a year here, provided the ewes are fed adequately during the dry season.

An attempt is being made to raise worm-free sheep on worm-free pastures as a means of avoiding the difficulties of controlling internal parasites; a trial of the use of cobalt "bullets" in raising steers has been started; arrangements have been made for study of the growth of Mashona cattle.

Effects of Leys. Several long-term experiments to assess effects of leys and ley-management on soil productivity have been maintained. One of these, after four years under grass has been ploughed in preparation for test-cropping with maize and tobacco during the coming season.

Veld. Trial of the "three-herd-to-four-paddock" system of veld management shows that steers make greater gains when given 14 acres of grazing each than when given lesser amounts. It also becomes clear that snatching even a little grazing during the resting year that is part of the system may jeopardize accumulation of enough grass for control of coppice by burning.

In comparisons of arboricides for use in bush clearance, the butyl ester of 2,4,5-T, applied in furnace fuel, seems much more effective in killing M'sasa than any other arboricide hitherto tried.

Irrigated Pasturage and Vlei Land. Various mixtures of annual grasses and legumes for irrigated winter pastures have been compared. In these oats have shown up very well, and in some cases the legumes have added not only to the quality of the pasturage but also to a surprising degree to its total yield, both at high and at low levels of application of nitrogenous fertilizer.

In co-operation with the Department of Conservation and Extension, assessment of the properties of tile-drains in sandveld vleis is being made.

An experiment in growing Rueppell's Clover in a sandveld vlei suggests that sulphur may be deficient in such situations.

The Chemistry Laboratory. Some two thousand herbage samples have been analysed during the year, mainly for their content of crude protein.

The laboratory has been altered and enlarged and is being equipped for routine analysis of dung samples for chromic oxide content.

STATION MATTERS

Staff. With all European posts occupied and only one change of staff during the year, staffing was stable. On the other hand, absences were unusually numerous and prolonged. Officers were on vacation leave for a total of 335 days, sick leave for 116 days and occasional leave for 44 days. Another officer was on study leave from April till the end of the year under review, and another was away for 28 days on military service during the recent Emergency.

Visitors. Some 500 visitors signed the Visitors' Book during the year, and it is estimated that at least an equal number escaped doing so.

Visitors included 32 parties of European farmers, African farmers, government officials, students and members of Young Farmers' Clubs.

Farm Cropping. In the arable rotation, which covers some 510 acres, there were during the year 310 acres of planted grassland, 55 acres of maize for grain, 18 acres of maize and velvet beans for silage, 19 acres of velvet beans for hay, 11 acres of soya beans for seed, and about 100 acres of experimental work. In addition there were 32 acres of irrigated pasture.

Despite adverse weather, yields of early-planted moderately fertilized maize, grown as the first crop after grass leys, averaged 22.6 bags per acre over 41 acres.

Farm Livestock. The Station's livestock included 69 dairy stock, 411 beef stock and 90 sheep at the end of the year.

The dairy herd was reduced in October to bring it into line with the Station's current programme, this being done by transferring 23 animals to the Henderson Research Station. The average output of milk for all lactations completed during the year, including those of first-calf heifers, was 10,243 lb. per 300-day lactation, with an average of 3.74 per cent. butterfat.

African School. The Station's African School, which caters for children up to Standard 2, had 73 pupils at the end of the year, 44 of them being boys and 29 girls. About 40 of the pupils are children of the Station's employees, while the remainder come from the surrounding district.

Arrangements are being made to include Standard 3 next year.

Buildings. Alterations and improvements to the Chemistry Laboratory and Pasture and Agronomy Work Rooms have been made, and a dutch barn, a seed-drying shed, a saw-bench and housing for the saw-bench have been built.

EXTERNAL ACTIVITY

In addition to the numerous talks and lectures given to visitors to the Station, 33 more were given to various gatherings in the districts, and 24 special advisory visits to farmers were made. Nineteen committee meetings were attended, and nine officers attended the Professional Officers' Conference held in Salisbury in June. The Officer-in-Charge attended three other conferences including the FAO/CCTA conference on Grain Legumes held at Bukavu, in the Belgian Congo, in November.

Under the auspices of the International Co-operation Administration, Mr. D. L. Barnes left for America in April for six months to study methods of pasture research.

In keeping with the general theme of the Ministry of Agriculture's contribution to the Salisbury Agricultural Show ("Recent Advances in Research"), the Station staged an exhibit of the work of its new bacteriology laboratory for dealing with the legume bacteria.

ACKNOWLEDGEMENTS

Very generous gifts of fertilizer were received from Messrs. Fisons (Rhodesia) Ltd., Messrs. Windmill Fertilizers (Rhodesia) Ltd., and Messrs. African Explosives and Chemical Industries (Rhodesia) Ltd.

The Station's thanks are due to Mrs. D. L. Barnes for her unstinted effort on behalf of the African School, and to Mrs. P. B. Kennan for helping her.

HENDERSON RESEARCH STATION

J. W. ROWLAND
Officer-in-Charge

GENERAL

The Henderson Research Station lies in the centre of the maize growing area of Mashonaland, and serves some 10 million acres of land, on which three quarters of the maize, more than half the tobacco, and roughly two thirds of the miscellaneous crops of Southern Rhodesia are grown. It supports one quarter of the dairy cows and one fifth of the European-owned cattle also.

With an annual rainfall average of 35 inches, the region is suitable for intensive systems and mixed farming. In the year under report 43.92 inches of rain fell but distribution was awkward. Difficulty was experienced in the spring with seed germination and in early March crops suffered from lack of water.

European Staff. Throughout the year the staff has been up to strength and all residential accommodation has been occupied.

Farm Development. The electrical ring main was reconstructed at considerable cost and power and light was installed in the new laboratory and office building. Roads, drains, bridges and buildings have been materially improved in the course of the year. Farm building developments have been achieved on the pasture and animal nutrition sections. The establishment of the metabolism unit on the animal section is nearing completion. Three to four miles of fencing have been installed and with the establishment of a further 150 acres of Rhodes grass, 450 acres of farm land have now come into a grass and crop long term rotation. Buildings have been greatly improved on the Crop and Irrigation Section by the erection of a machine shed and extensive reconstruction of the existing building. Livestock numbers on the Station have been maintained at a level of some 450 head. The summer milk production project has now reached a stage where the principle of seasonal milk can be investigated. Steady development has taken place on the Fisheries Research Centre with the construction of improved patterns of rice paddies and fish ponds together with improved sluices. The return furrow from the Savory Dam to the ponds is nearing completion.

GENERAL NOTES ON RESEARCH

The work is showing the way through from the old time monoculture of crops and the traditionally separate livestock production methods into intensive and diversified crop, ley, and livestock production. In all the investigations the over-riding importance of nitrogen is making itself felt, and is being increasingly appreciated by the farming community as a whole. Not only do fertilized pastures improve soil far more rapidly than the customary grass fallow, but their carrying capacity is greatly in excess of that found on natural veld. Diversified husbandry not only leads to more stable conditions as far as soil fertility is concerned, but also lends greater elasticity to the farming system in that the farmer can produce more or less grain, as the markets dictate, and expand his livestock production where desirable. Whereas it has not been exceptional hitherto to commit 25 acres of veld grazing to raise two cows with an expected production of one calf between them, improved fertilized pastures grazed by cows which are given the necessary nitrogen and phosphate additives can produce a calf a year from two acres. The studies on nutrition however have shown that 300-400 lb. liveweight increases are to be expected from two acres of improved pasture, and that slaughter steers can be produced weighing 1,000 lb. at three years of age, at greatly reduced cost.

On the crop and irrigation side the use of 40 lb. boron per acre has induced excellent growth of lucerne which has been extremely difficult to attain hitherto. Fertilizer and variety trials of many crops have continued. Continuous maize grown on the new high population/trash farming methods has maintained high yields on experimental plots, of the order of 24 bags per acre. "Continuous" maize has now been grown on the same plot for six years without any appreciable loss of heart in the soil.

The erosion experiments have continued according to plan, and the main developmental activities of this Section have been the extension of their work throughout the country using this Station as a base.

A full account of the work of the Conservation and Extension Section is given in a separate report.

The Intensive Farm Unit has been reported on in detail in a separate report covering activities from inception to October, 1958, and useful information relative to intensive tenant farming has already emerged.

It is quite clear that *a tenant can start farming with £5,000* on 300 acres here, if he can get loans for a further £2,000. It is clear also that *minimum landlord's expenses on land improvement are in the region of £5,000* for buildings, fences, roads, power, house and water. (The cost of the land is additional to this.) For the tenant, £500 per year rent is not excessive; *for the landlord, with a total capital commitment of £7,000 on land and improvements this gives a reasonable return,* seeing that the system in operation is improving the property year by year. It has been shown beyond reasonable doubt that with an overall initial capital input of £14,000 the enterprise can contrive a gross annual output of primary products of £7,000—a Capital Input to Gross Output ratio of 2 to 1. This is a favourable ratio and worthy of financial support. Lastly it has been shown that one European tenant with 14 African workers can operate this farm—and this calls for a *capital input per employee* of less than £1,000. By comparison it is noteworthy that on the copper mines a commitment of £10,000 of capital for every employee is common. This ratio of one European tenant per 14 African employees is biologically sound so far as the operation of the farm is concerned and is an interesting ratio in relation to the national situation, in that the enterprise is highly productive, is economic and to all appearances self-maintaining in so far as soil fertility is concerned. Hitherto the profits on the enterprise have not exceeded £1,000 per annum. The herd has only recently achieved a steady production level of over 80 gallons per day, and larger profits in normal years can reasonably be expected within the present price structure.

Work has extended on vegetable seed production since a late start in the middle of the rainy season. It is hoped that future work will include a determined investigation of the causes underlying the high costs of milk production, presumably calling, *inter alia*, for improved methods of calf rearing, improved dairy buildings and facilities, increased knowledge of forage rotations for dairy stock, the development of more efficient strains of livestock, from the milk production, feed conversion and health standpoints.

The first step in the achievement of lowered costs and higher and more efficient production both from cattle and field crops is the use of greater quantities of nitrogen and phosphates as feeds and as fertilizers. It is clear also that the use of these substances provides the only way whereby soils can be maintained and improved under the increasing economic and social pressures. As this development is certain to come in the near future, every effort is being made to prepare for the coming rapid expansion of agriculture by acquiring knowledge and experience appropriate to the new conditions as they arise.

PASTURE RESEARCH SECTION

Investigations have been continued to establish productive forage sequences for specific classes of stock, such as breeding cows, weaners, heifers, tollies and dairy cows, with particular emphasis on the characteristic nutritional needs of each. The results from this work have revealed the overall pattern of production and indicated details of the sequences which require attention.

In all instances where the veld was used to provide summer grazing, the low productivity of this feed was evident. The provision of four acres of well-managed veld was only sufficient to carry one breeding cow for 70 days in mid-summer, during which an average 33 lb. of liveweight increase was recorded.

To provide the breeding animals with sufficient grazing it was necessary to make extensive use of the vlei grazing during spring, early summer and autumn. Under these circumstances, three acres of vlei provided one animal with adequate grazing for satisfactory liveweight gains during 127 days of spring and early summer grazing, in addition to 70 days of autumn grazing.

The results stress the need to differentiate clearly between veld and vlei grazing in the assessment of carrying capacity, and consequent animal production.

The use of veld for growing out beef steers in summer, indicates that some 150 lb. of liveweight increase may be expected from animals which have been on an over-wintering ration to gain 0.75 lb. daily. Foggage pastures fertilized with 40 lb. N per acre, applied early in the season, provided satisfactory yields of herbage for winter use. When this herbage was grazed *in situ* it provided 126 grazing days compared to 231 feeding days when it was cut and stacked in late autumn. There was no difference in the quality of these two feeds and both provided a maintenance diet when supplemented with urea.

Late cut jack bean hay, coarse milled through a hammermill, proved to be a convenient method providing a portein supplement for dry dairy cows and over-wintering beef steers. Yields of hay exceeded two tons per acre in all trials and when this was fed, in addition to late cut grass hay, daily liveweight gains of 0.75 lb. per head were recorded.

It is clear that foggage pastures supply adequate herbage for winter use and satisfactory planes of nutrition can be obtained when this is supplemented with protein additives. The inability of the veld to provide sustained and satisfactory production during summer indicates the need for further work in this direction.

Investigations into the production of seasonal milk from summer grazing pastures have been firmly established. Preliminary results have shown that where pastures are fertilized with 80 lb. nitrogen and 200 lb. superphosphate and stocked at the rate of one dairy cow per acre, 26 weeks of grazing are obtainable.

A detailed study of this grazing season has shown that the quality of commonly grown grasses is subject to a very strong seasonal influence. The initial problem is the rapid fall in the percentage of protein during the growing season and the difficulty in controlling this through practical and economic means. It is apparent that further study is required on the carbohydrate-protein relationships in alternative species with a view to obtaining a better balanced feed over a longer period.

Further experiments on the establishment of pastures by seeding under maize and legume crops have proved this to be a satisfactory method and practicable under high plant populations.

A comparison of the effects of fertilizer nitrogen from various sources indicated that grass yields were solely dependent on the amount of nitrogen applied, irrespective of the source.

FIELD HUSBANDRY AND IRRIGATION SECTION

During the latter part of the year activities became narrowed down from covering a wide range of crops under dry-land and irrigation to crops and vegetables under irrigation, only retaining some of the more important dry-land experiments.

The sixth year of continuous high production maize gave a yield of 23.7 bags per acre as opposed to 22.0 bags after an alternate maize/green manure system, 24.3 bags and 29.4 bags per acre for the first and second maize crop after legume for silage (plus manure) respectively. The reason for the latter high yield is difficult to explain but may become clearer in years to come.

Maize hybrids continued to out-yield open-pollinated varieties by up to eight bags per acre. As in the past, maize receiving one or two hand cultivations yielded as well as maize receiving various types of pre-planting, pre-emergence and post-emergence herbicide treatments. These treatments included Eptam, Simazin and wettable powders which did not show up much better than pre-emergence 2,4-D. Not as great a benefit was obtained from nitrogen in the maize population-fertilizer experiment as in past years. This may mainly be ascribed to late replanting which had been due to poor initial stands.

Winter grown small grains produced interesting results, while summer wheat continued to be disappointing. Monocotyledonous weeds and rust remain the main problems in summer wheat growing. A pre-emergence herbicide weed control experiment showed no success, while a machine-planted and cultivated crop may have been a success had a rust resistant wheat been available, and herbicide treatment at the last cultivation to control broad-leaved weed, been applied. Of all the varieties tested out F21 B3 produced 4.1 bags per acre, the highest yield.

The two most successful wheat varieties during winter, 1958—F 84 Gabo (16.4 bags per acre) and F 93 Kenya (19.4 bags per acre)—have both unfortunately succumbed to a virus stunt, "streak" or "mosaic" disease during winter, 1959, which has considerably reduced yields. Definite responses have been obtained to nitrogen and differential water applications. Barley continues to produce poor yields for the third winter running, the reason for this not being known.

Lucerne, which gave considerable difficulty in the previous two summers, has responded well to boron applications. The main effects from boron, phosphate and lime were as follows: 1958-59 season. Total yield in tons oven dry material per acre:

No Boron	4.6
40 lb. Fertilizer Borate/acre	6.8
No Phosphate	5.5
300 lb. Triple Superphosphate/acre	5.9
No Lime	5.5
3,000 lb. Agricultural Lime/acre	6.0

Of the lucerne varieties tested India was by far the best with Provence, North Washington and South Africa Commercial showing promise.

Soya beans did not respond markedly to fertilizer applications of boron, phosphate or lime. Variety No. 237 produced the highest oven-dry hay yield of 3.0 tons per acre, and No. 147 produced 14.7 bags per acre of grain out of eight varieties tested. Benares, a new introduction from Nyasaland, is much later than the other strains and shows promise as a hay, silage or green manure crop. Some selection and breeding work with this variety is warranted.

Groundnuts were relatively successful with Virginia Bunch, planted 10th December and lifted 9th May, producing 29.4 bags (75 lb. unshelled) and Valencia, planted 10th December and lifted 30th March, producing 24.2 bags per acre. Selections from 221 single progeny rows should prove useful material from which to obtain suitable locally adapted groundnut varieties for future use.

Irrigated potatoes continued to produce high yields. In one experiment, frequent light irrigations gave similar yields to frequent or infrequent heavy irrigations. In three separate experiments over the past two years it has been shown that a straw mulch, placed between the rows of irrigated potatoes does not increase yields.

Excellent yields were obtained from cotton during summer 1958-59. Albar 637 planted on 10th November produced 2,315 lb. total seed cotton or 726 lb. clean lint per acre, in a variety experiment. In a supplementary irrigation: time of planting experiment, the following yields in pounds of clean seed cotton per acre were obtained:

Planted 15th October	3146.7
„ 1st November	2976.9
„ 15th November	2317.6
„ 1st December	1275.7
„ 16th December	431.4

There was little difference between the yields obtained from eight varieties of kenaf which produced an average yield of 1.06 tons retted fibre per acre.

Significant differences were obtained between varieties, times of planting, methods of planting, of onions. The effects of the main treatments were as follows (120 lb. bags per acre):

Variety Cape Flat ...	255.6	Planted 18th March, 1958 ...	254.8
„ Texas Grano ...	268.5	„ 1st April, 1958 ...	254.3
„ Bombay Red ...	173.5	„ 15th April, 1958 ...	188.5
Spacing 9″ x 3″:	237.2	Planted in seedbeds then transplanted	227.7
„ 12″ x 3″:	227.9	Planted in situ	207.3

Pea seed production experiments have shown marked differences between yields obtained from different varieties and times of planting. Yields have, however, been disappointing, the highest during 1958 being 540 lb. per acre and 1,000 lb. per acre during 1959. Only slight and inconsistent responses have been obtained from fertilizer applications. Peas pose more problems than are generally realized and large scale production should not be contemplated until more is known about their cultural requirements.

From two seasons of lettuce seed experiments it appears that this may become a promising crop. Yields were low during 1958 (140 lb. per acre the highest) but marked differences were obtained from different times of planting. These differences may be mainly due to the incidence of frost during flowering. Better yields are expected from the 1959 crop.

Cauliflower (variety—All Year Round) planted on the 23rd March, 1959, and transplanted on the 14th May, 1959, has set a good crop of seed. However, other observation plots with cabbage, kale, flowering broccoli, spinach, onions, and beetroot have not been successful in producing seed.

ANIMAL HUSBANDRY SECTION

Studies on yield and seasonal composition of veld have been carried through two complete seasons and one more seasonal replicate is required before the work is terminated. The studies are complementary to those on seasonal digestibility changes discussed below. Progress has been satisfactory and no difficulties are anticipated in the future.

Routine digestion trials on a wide variety of feeds have continued without interruption through the year. The feeds include fortnightly veld samples, numerous legume hays, silages, and seeds. Feed samples from two co-operative trials from Gwebi and Matopos have also been put through for digestibility determinations. The trials have recently been stopped to allow the chemical analyses of samples to catch up.

During the year two check periods to test the technique of chromic oxide: herbage consumption estimations were carried out. The objects were to study the accuracy of the existing method and to explore the possibility of changing the dosing and sampling times to economize on labour. The analyses of these samples are not yet complete and it is only possible at this stage to say that the existing method appears to be sufficiently accurate.

The field application of the technique to grazing animals has been in progress for a complete year, where the herbage consumption and quality pattern of Africander and Mashona cattle are being determined. This work will continue for at least another year. It might then be extended to include other age groups.

The original project on the influence of nutrition on fertility of beef cattle has been in progress for about three years and results to date have been very satisfactory and informative. No difficulty has been encountered and the work will continue without change for another two years.

Arising out of this initial study, differential mineral treatments were imposed on an Africander herd during last winter. This work has now been extended to include a herd of Mashona cows and the effects of feeding supplementary vitamin A is also being studied.

Studies on the influence of mineral and winter protein supplements on growth and mineral storage in young stock have been in progress for the past 16 months. The broad plan provides for a study of the effects of varying protein and mineral supplements to veld on the growth of young stock from 300 to approximately 900 lb. weight. In order to obtain some indication of the mineral status of these animals at various periods, selected groups are slaughtered at six-monthly intervals from weaning to $2\frac{1}{2}$ years. The minerals studied are bone ash, blood phosphate, haemoglobin, liver copper and cobalt values. It is intended to have three yearly replicates to spread seasonal effects over the various age groups. The second calf crop is at present in its first winter treatment.

Studies on the relation between nurition and parasite burden in sheep were initiated in May this year. In consultation with the parasitologist from the Veterinary Department a very simply designed trial, more in the nature of a survey, was started to study the effects of two levels of winter feeding in all combinations with three dosing treatments, on the worm egg counts of the sheep faeces. Suitable equipment and animals have been obtained and the work is proceeding satisfactorily.

A small flock of Blackhead Persian sheep were transferred from Karoi Experimental Station to serve as a nucleus of a breeding flock for future studies on these animals.

It is proposed that the work be carried on in its existing form for at least one year. The information derived during this period can then be used to assess the problem more accurately and to design more comprehensive studies.

Authority to proceed with nitrogen balance studies was given at the last Research Advisory Committee meeting. Funds were allocated in the last financial estimates and the building and construction of the equipment is almost complete. It is considered, however, that at least one year is needed to test and perfect the techniques to be used.

FISHERIES SECTION

General. The year under report was a favourable one for the staff, as all of them had an opportunity, either in an official capacity or privately, to refresh their knowledge and to gain new knowledge and experience by visiting fisheries institutions and attending fisheries courses and conferences overseas.

Routine research work developed normally and according to the research programme, within the limits of available financial resources. Due to financial restrictions, not all research could be carried out to final results, and has been replaced by the continuation of some experiments which were judged to be more urgent and important as a result of achievements in the previous year. In many cases optimum results will never be achieved as long as the respective ponds are not protected from predatory animals.

Research results achieved at the Fisheries Research Centre are already adequate to indicate a more than reasonable and economical production in fish culture, and to give satisfactory guidance for the establishment of a productive fisheries industry.

The implementation of the research results by prospective fisheries industries will probably have to wait until there is some kind of a centralized Federal fisheries propagation institution.

The Chief Fisheries Officer was invited by the International Union for the Conservation of Nature and Natural Resources to address the Seventh Technical Meeting held in Athens, where he presented a paper on "Dams and Drawn-out Streams Fisheries in Southern Rhodesia".

After the above mentioned meeting the Chief Fisheries Officer visited Yugoslavia, Israel, Italy, France and England.

Yugoslavia: The main object of this visit was the study of the organization and management of the big (up to 3,000 acres) fish pond cultures. In this connection the Chief Fisheries Officer gave two lectures on research and principles of Tilapia culture. One lecture was given at the University of Belgrade and the other to fisheries officers of the Federal Fisheries Administration.

Israel: The visit to this country was mainly undertaken with a view to studying the reasons for the gigantic progress made in that country during the past ten years, where carp culture has developed from nil ten years ago to a yearly production of 4,000,000 lb. from 4,000 acres of ponds at present. Two lectures were given by the Chief Fisheries Officers on Tilapia culture, one at the Freshwater Fisheries Research Establishment, and the other at a co-operative farm with the best established fish culture.

Italy: The F.A.O. Mediterranean Fisheries Council Annual Conference in Rome was attended.

France: This visit was undertaken mainly to discuss fisheries problems in connection with major dams in French Equatorial Africa, with Dr. J. Lemasson, Directeur du Centre Technique Forestier Tropicale.

England: Institutions such as the Government Fisheries Research, Nature Conservancy, Natural History Museum, Fisheries Department, etc., were visited with a view to gaining useful information and establishing personal connections.

Visits to France and England were not sponsored by the Government, and were undertaken privately.

The Fisheries Officer attended a F.A.O. course on Fisheries Statistics and Administration in Copenhagen, and also had an opportunity for studying all aspects of the Danish Fisheries Industry. On his way to Copenhagen he also studied the F.A.O. Fisheries organization.

The Technical Officer, while on leave in Europe, took the opportunity to study recent achievements in fisheries in Sweden.

Publications. The following works have been published during the year:

(1) "Proceedings of the 1st Fisheries Day" (84 pages).

(2) A. Maar. "Dams and Drawn-out Streams Fisheries in Southern Rhodesia" (15 pages).

Research Results. The main object of research in fish production is to find possibilities to produce fish on an economical basis and to establish the limits of production. From the work up to date the following summary of main conclusions regarding the tilapia culture can be drawn:

(1) Stocking rates with Tilapia of below six ounces: 25 lb./acre for extensive culture without feeding or fertilizing, 100-200 lb./acre for semi-intensive culture with fertilizing, 750 lb./acre for intensive culture with fertilizing and feeding, or 1,000 lb./acre for intensive culture with intermediate fishing.

(2) Production per acre a year: 200-500 lb. with a maximum of 700 lb. in natural waters or extensive culture, 1,000 lb. or more on fertilized ponds with single species, 1,300 lb. or more on fertilized ponds with mixed species of Tilapia, up to 5,000 lb. on fertilized ponds with artificial feeding.

(3) Carp culture is very promising, as a carp fingerling of the size of two to three inches may reach the weight of two pounds in a year. In

Israel the maximum production per acre per year is just over 4,000 lb. and considering better climatic conditions in Southern Rhodesia, the results could not be less satisfactory.

(4) Trout rearing in ponds in also promising. It is possible to raise in one year the trout from egg stage to the weight of one pound or more. In North and Middle Europe the same stage would take up to three years. Economically, trout rearing in ponds is perhaps not a reasonable proposition until a cheaper substitute for the trout food used at present is found.

(5) Apart from practical problems the Fisheries Section was engaged in the solution of basic problems such as:

(i) The determination of suitable species for fish culture.
(ii) Comparison of strains of culturable fish.
(iii) Hybridization.
(iv) Density of fish population.
(v) Integration of fish culture into farming practice.
(vi) Rice and fish culture.
(vii) Natural history and systematics of fish.
(viii) Exploration of natural waters.
(ix) Weed control.
(x) Fish pathology.
(xi) Fish exploitation in natural waters and dams.

Profitability of Tilapia Culture. Attempts have been made to establish the profitability of intensive Tilapia culture on a commercial scale. For this purpose experiences gained by the section research as well as information from other sources were taken into consideration.

A fish culture with 100 acres of water surface should give a net profit of £5,000 a year. Calculations are made on a fully established fish culture, with maintenance and running costs calculated at highest market prices, with a production of 3,000 lb./acre/year, and a gross selling price of one shilling per pound delivered.

Development of Fish Industry. Attempts to persuade farmers to go into fish culture have so far resulted mainly in the stocking of dams. Most dams are stocked at present, as compared with only about 5 per cent. of dams stocked in 1951, but the fish production is mainly used for sporting purposes, home consumption, and in the best cases for labour rationing. In order to get cash returns the fish culture on farms must be built up on a commercial basis similar to other branches of agriculture.

The fact should be stressed here again that no other branch of agriculture is able to compete with fish culture in quantities of protein produced per acre and prospective cash returns.

When recently consulted on the possibilities of establishing a big pond fishing industry in Arkansas, United States of America, the world authority on pond fish culture, Dr. Cho-Wen-Ling, suggested first establishing a Fisheries Research Station, and basing the new industry on scientific results achieved by such a station. A suggestion made by a world authority does apply to all parts of the globe, and we in this country have already passed the first stage.

The next stage should be the development of a fish industry, to which end here should be an approved policy on fish production and the establishment of an executive and advisory organization. The lead of the Israeli fisheries organization might be followed in this respect, as invaluable information could be drawn from their achievements and experiences.

A large potential lies, for instance, in the big dams of Southern Rhodesia, but so far only on Lake McIlwaine are the resources exploited to some degree.

Advisory. Considerable time was spent on showing around visitors attending field days, and visiting farms for advisory purposes.

MATOPOS RESEARCH STATION

(Including the Nyamandhlovu and Tuli Stations)

J. M. RATTRAY, *Officer-in-Charge*

INTRODUCTION

Staff. Two vacancies on the professional staff remained unfilled at the end of the year and great difficulty has been experienced in obtaining suitable candidates for them. The resignations of three Technical Assistants will take effect during the next two to three months.

Housing. One new married quarters was completed, and very substantial alterations were made by the P.W.D. to two of the older houses during the year. A considerable amount of maintenance work, however, still remains to be done.

Native School and Beer Hall. These continue to run satisfactorily. Ninety children attend the school which has a staff of three.

Compound. Eleven new huts have been constructed as replacements and the seven single quarters commenced last year have been completed.

Crops. One hundred and forty acres of maize were planted and 660 tons of silage and 140 bags of grain were harvested from them. One hundred and forty acres of velvet beans yielded 5,800 bales of hay, or approximately 138 tons.

Bilharzia Campaign. In accordance with the spraying campaign organized by the Matopos North I.C.A., all the rivers, dams and irrigation canals on the Station (including Mdanyazana and Tonbridge) have been treated. They were first sprayed with P.C.P. but as this did not prove altogether satisfactory in water on the schist areas much of the latter was resprayed with copper sulphate. Very good kills of snails have been obtained in most places.

General. A large number of conferences, meetings and farmers' days, etc., were attended by various members of the staff, who often accompanied officers of the Department of Conservation and Extension on advisory visits as well.

The Station contributed to the Government Exhibit at the Bulawayo Agricultural show.

Apart from many individual visitors, groups of farmers, conservation officers and scholars and bodies such as the Natural Resources Society also visited the Station.

FIELD HUSBANDRY

The season was a short one of about 79 days, in which 16.08 in. of rain fell,

Dryland Agronomy. Work continued on maize and sorghum populations and maize fertilizer requirements. The optimum population for maize was again found to be about 14,000 plants per acre (3 ft. x 12 in. spacing) and with sorghums continuous planting in 18 in. rows was again found to give yields about 25 per cent. higher than conventional spacings.

Maize yields were increased by nitrogen and phosphorus on the lighter soils but not on the heavier soils, confirming previous results.

Silage work consisted of crop comparisons at different spacings; on the heavier soils forage sorghums again outyielded maize and averaged over 15 tons per acre. On the granite sands millet, averaging over 12½ tons per acre, again outyielded maize and forage sorghum. On all soil types and with all crops, close spacings gave yields up to 30 per cent. higher than wide spacings.

Digestion trials were carried out on a number of the silage trials so that results can be expressed in terms of digestible nutrients as well as yield per acre.

With the hay crops once again little difference was found between crops, yields ranged from under one to over two tons per acre, but close spacings increased yields by 25 per cent. over wide spacings.

The castor bean programme was concluded with 12 trials at various localities. As in the past, yields were increased by nitrogen and this season yield increases were also obtained from phosphorus; varieties differed significantly and overall yields ranged from 180 to 1,364 lb. (decorticated beans) per acre.

In the preliminary groundnut programme the earlier maturing Spanish Bunch gave the highest yields and close spacings also increased yields which, at Matopos, averaged 6.38 bags (180 lb. shelled) per acre.

A number of rotation and cultural methods trials continued; in the stubble mulch trials the two tons per acre compost and clean cultivation treatments again gave higher yields than the mulching or ploughing-in of the stover. Nitrogen applied at mid-winter resulted in higher yields than the planting or top-dressing time of application. In the Lister trials on maize the indications at Matopos were that flat planting is better than lister or basin planting on the granite sands and that there is little difference on the heavy soil, while at Nyamandhlovu listers and basins may increase yields in some seasons.

Irrigation Agronomy. More trials were carried out on the recently completed red soil irrigation unit. Loman was the highest yielding potato variety, giving 80 bags (150 lb.) per acre and for the third year early planting of potatoes resulted in higher yields. Late September plantings gave 137 bags per acre and early November plantings 89 bags per acre.

Silage crops under irrigation did not differ, the average yield being 21 tons per acre, but close spacings increased yields, of all crops, by as much as 25 per cent.

Of the hay crops under irrigation, dolichos beans gave the highest yield, over three and a half tons dry matter per acre and here again close spacing increased yields of most crops by about 15 per cent.

New trials were started on lucerne varieties and spacings and on winter green soiling crops; of the latter, oats gave the highest yield of 3.87 tons dry matter per acre in two cuts followed by wheat, barley and Italian rye, which did not differ. The 3.4 tons per acre from barley and Italian rye, were, however, spread over three cuts which may be of advantage. The higher seed rates of these crops (120 lb./acre) increased yields by 15 per cent. over the lower seed rates (60 lb./acre).

Plant Breeding. The resignation of the Plant Breeder and the failure to recruit a successor has led to a reduction in this work. In the maize variety trials American White Flint x K64 recovered, a cross made at Matopos, S.A.4 and S.A.9N., a yellow dent and a white dent hybrid respectively, from South Africa, and B7203B, a yellow flint experimental hybrid from Bethlehem, South Africa, were the top yielders while a number of the varieties commonly grown locally, such as Potchefstroom Pearl, Sahara and Golden Beauty were well down the list of 36 varieties grown.

In the sorghum variety trials the highest yields (up to 20 bags per acre) were obtained from hybrids introduced for the first time from the United States; a number of Feterita selections introduced from the Sudan in 1956 also did well.

Crop Ecology. A number of trials conducted at Matopos were repeated at Nyamandhlovu, Gatooma, Tjolotjo and Gwelo and these will provide valuable information on differential response to climatic factors. Other work connected with crop ecology included soil moisture studies, using gypsum blocks, the results of which have still to be analyzed.

ANIMAL HUSBANDRY

Development. During the period under review five miles of new fencing were erected on Lucydale and Lonsdale farms.

On the main Station a new weighbridge was installed, two cattle kraals were built and 1,000 yards of fencing was erected to subdivide the hay paddock to carry out critical tests on the effect of mineral feeding on the growth and reproduction of beef stock.

Research on Beef Production. (a) Animal Breeding: The breeding trials in which a determination is being made of the effect of environment on selection for economic characters continued according to plan.

The results given below show to what extent beef production may be increased by feeding locally produced fodder crops to the normal run of stock obtained in this area.

	Veld Grazing	*Fed in Winter*
Calving percentage	60	85
Birth weight	68	71
Weight 12 months January	375	556
Weight 18 months June	460	673
Weight 24 months January	550	830
Weight 30 months May	670	920

From a marketing point of view, however, 80 per cent. of the steers fed in winter were unfinished at the end of their second summer after weaning and for such a system of farming to be successful it will be necessary to increase the rate of maturity through selection.

In this connection promising results are being obtained with regard to the progeny testing of different beef series.

(b) Breed Comparisons: This investigation is yielding valuable information with regard to the reaction of different breeds to varying conditions of management. From the results obtained it would appear that as compared with the native stock the inability of the Hereford cattle to adapt themselves to conditions of free range may partly be ascribed to the rapid deterioration of their temporary incisor teeth when nutritional conditions are at their worst in winter.

This observation seemed to indicate that the early maturing breeds may be more susceptible to mineral deficiencies than the indigenous cattle. In feeding bonemeal to gestating cows it has, however, been found that the blood phosphorus content of animals so treated is lowered significantly.

This problem is receiving further attention.

Sheep. The rearing of sheep is becoming increasingly popular in Matabeleland and the mutton production studies in progress on this Station have been intensified to study various problems pertaining to the breeding and feeding of sheep in this area.

Dairying. In order to determine the effect of various environmental factors on the production of milk in Southern Rhodesia an analysis is being made of the milk records collected by the Dairy Branch.

POULTRY

Development. A laying house to accommodate 550 hens is nearing completion. A Commercial Egg Laying Test was started in March, 1959, and will be extended in 1960.

Experimental Work. Results of growth comparison experiments with chicks reared on cement floors and wire floor cages, indicated that cage reared birds gain more weight at 10 weeks of age than birds reared on cement floors, but that they are more prone to hock disorders and breast blisters. They also seem to convert food more efficiently.

Breeding. Selective inbreeding for economic qualities has improved the New Hampshire flock kept at this Station over the last two years.

The crossing of White Plymouth Rocks and White Australorps for table production is very promising. The progeny is white feathered and white skinned, which is a desirable characteristic in table birds. Growth rate is satisfactory and compares favourably with New Hampshires.

Feeding Trials. Data collected on the feeding of high energy-low fibre mashes indicates that less than three per cent. and more than four per cent. fibre is undesirable in broiler mashes.

Observations made on intensive housing of poultry indicates more efficient management, disease control and labour utilization.

Shows. Judging was done at Gutu, Gwelo, Gwanda, Wankie and Bulawayo Shows. An exhibit was staged at the Bulawayo Show.

Extension Work. During the year 84 farms were visited, and 86 farmers visited the section.

Lectures were given to Y.F.C. and Farmers' Associations and eight meetings were attended.

General. Orderly marketing of poultry products is still the main concern of poultry farmers. A Commission of Inquiry into the production and marketing of poultry products is desirable.

PASTURE RESEARCH

Development. Very little development work was carried out during the year. Apart from some new lucerne trials the only experiment put down was a bush control trial incorporating goats and cattle.

Research. (a) Veld Management Experiments: At Matopos the veld management trials continued. Belt transects indicate that there is very much more bush (particularly seedlings and young trees) in paddocks never burnt than in regularly burnt paddocks. The useful effect of fire in controlling bush is now visually apparent in trials which have been running for some years. The *Terminalia/Burkea* association on the sandveld is apparently less resistant to fire, however, than the *Acacia* on the heavy soil. In Experiment 8, on the sandveld (three paddock, one herd with burning-summer grazing only) the bush density has been reduced very considerably since 1948 by burning and the stocking rate could, at this stage, be raised. It will, however, continue to be stocked at the present rate in order to provide hot fires to bring about further reduction of the bush as quickly as possible.

In the stocking rate trials all cattle have done badly this year and it is likely that supplementary feeding of those in heavily stocked treatments (i.e., grazing pressures greater than 1:10) will have to take place as a life saving measure before the end of the dry season. Paddocks stocked at 1:5¾ and 1:8 on the sandveld and 1:6, 1:7½ and 1:9 on the thornveld are grazed very bare and one would expect major vegetational changes to take place in these paddocks in the near future. In some paddocks *Cymbopogon plurinodis* is the only ungrazed grass—an indication of the extreme unpalatability of this species.

At Nyamandhlovu steers running in a system of management using three paddocks to one herd, with burning on Kalahari sand, continue to do better than steers run in two paddocks with no provision for burning. On this veld type burning at intervals of three years is proving most effective in reducing bush density and preventing encroachment.

On black basalt at the same station it has been shown that it is possible to carry 66 per cent. more animals per unit area if all but a few shade trees are removed. This results in a 43-60 per cent. increase in the amount of grass produced. In this area steers apparently derive no benefit from browse. Stocking rate trials continue on both the black and red soils but no conclusions can be drawn as yet.

It has been shown that steers running on old lands (reverted to *Cynodon dactylon*) do better when stocked at 1:6 than do steers stocked at 1:20 on the veld. Further work on these couch pastures is projected.

At Tuli not many conclusions can be drawn as yet but it would appear that the veld can safely carry one mature steer to about 25 acres, and that the four paddock, three herd system of management is preferable to more complicated systems. The value of fire as a bush control measure in the lowveld has not yet been fully investigated but it would appear to have a less important role than in the highveld.

Although it has been shown that cattle spend up to 17 per cent. of their time browsing in the lowveld it has also been shown that they do very much better in cleared paddocks with no access to browse. In such paddocks steers stocked at 1:15 have averaged 82.3 lb./head/year heavier than their counterparts in bushed paddocks over four years. At a stocking rate of 1:20 the weight advantage has averaged 103.5 lb./head/year. Grass yields have been measured in the cleared and uncleared paddocks for the past three seasons and an average of 180 per cent. more grass has been produced as a result of clearing.

(b) Bush Control Experiments: (i) Burning. Burning experiments at *Matopos* indicate that a good fire once in three or four years at the end of the dry season before the rains set in effectively controls bush and to date (after 13 years) has no deleterious effect on the grass. Burning more frequently (particularly annually) has been effective in controlling bush but the grass cover has deteriorated badly, especially on the red soil, and erosion is rife. Burning at other times of the year is less damaging to the bush but is also causing great damage to the grass. There is some evidence to show that two burns in successive years at the end of the dry season at intervals of six to eight years gives very satisfactory control of bush.

In similar experiments *at Nyamandhlovu* much the same results are being obtained. Frequent burning on red sandy loam at this station causes *Heteropogon contortus* to become the dominant grass, but where burning takes place at intervals of three years or more, *Themeda triandra* dominates.

(ii) Chemical Control. At Matopos it has been demonstrated that *Acacia karroo, A. nigrescens* and *A. nilotica* can be effectively killed by ring barking, with diesel fuel or with the butyl ester of 245T in dieseline. Only the latter treatment kills *A. gerrardii*. In another experiment on an area of 7.4 acres all trees were treated with Diesel fuel. Of 22 species treated only the *Acacias* mentionsd

above were seriously affected. Cost of treating the whole area was approximately 10s. per acre but this would be greatly reduced if only susceptible species had been treated.

At Tuli a number of lowveld tree species were treated with ammonium sulphate during the year. Treatments appear to have been ineffective.

(iii) Control Through the Use of Goats. A new trial incorporating goats at different stocking rates and cattle and fire was started *at Matopos* early in the year. No results are available as yet but almost all woody species are being heavily browsed.

At Tuli a similar experiment has been running for a number of years and the goats appear to be reducing bush density somewhat. Most specimens of *Commiphora mosambicensis* have been completely ring barked.

(c) Plant Succession Experiments: On red soils *at Matopos* continual heavy grazing quickly destroys perennial grasses and reduces the cover to one consisting principally of *Eragrostis patentipilosa* and *Chloris virgata.* At the same time *Acacia* spp. are greatly encouraged. After such treatment five or six years under complete protection are required for recovery. Moderate summer grazing continued year after year has the same effect although deterioration takes place more slowly.

On the Matopos granite sandveld similar treatments are not nearly so damaging and the cover has been reduced to one consisting chiefly of *Digitaria pentzii.* This is no longer vigorous but the ground coverage is good.

At Nyamandhlovu when similar experiments were laid down the veld was at a low stage of succession as a result of drought, and practically no perennial grasses were present. As a result all plots grazed during the growing season have remained in this condition but *Themedia triandra* and *Heteropogon contortus* have re-established themselves under winter grazing or complete protection.

(d) Veld Fertilizer Experiments: Very big responses in grass yields have been obtained on the *sandveld at Matopos* from the application of 600 lb. or more of sulphate of ammonia. On *black soil* the response has been smaller whilst on *red soil* the increase is significant.

At Nyamandhlovu on *red soil* the increase in yield obtained from sulphate of ammonia was negligible this year although in the past the response has been very significant.

(e) Feeding Trials: At Matopos two groups of three and a half year old steers have been fed since June, both groups receiving Rhodes Grass hay *ad lib* as a basic ration. One group, receiving two pounds cotton-seed meal per head per day, has so far gained approximately 90 lb. per head. The other, with 4 oz. urea and 32 oz. molasses per head per day has maintained weight but would appear to have lost considerably in grade.

In mineral feeding trials *at Nyamandhlovu* a daily dosing with one ounce monosodium phosphate induced a 100 lb. per head weight response in nine month old steers within the first six months since when no further advantage has been noted. The steers are now two and a half years old. In a second trial with weaner steers one ounce monosodium phosphate/head/day has given a 60 lb. response to date, and half an ounce a 45 lb. increase. No response to cobalt has been noted.

(f) Dichapetalum Cymosum Control (Nyamandhlovu): Spraying trials indicate that where *Dicapatelum cymosum* is sprayed with the butyl esters of either 245T or 24D kills of up to 70 per cent. can be expected. Work continues on the problem.

(g) Dry-land Pastures: No new grass pastures were established during the year but the dairy herd continued to make good use of the 40 acres established near the nursery and the Rhodes Grass on Lonsdale was mown and utilized in the cotton-seed and urea feeding trial quoted above.

In a five-year-old fertilizer trial on Gold Coast Napier fodder on black soil the response to dressings of up to 900 lb. sulphate of ammonia, 200 lb. superphosphate and 100 lb. muriate of potash per acre has been disappointing and the trial has been discontinued.

Dry-land lucerne trials produced yields of over two tons dry matter per acre and indicate the need, on red schist soils, for applications of phosphate and boron. Further trials to investigate the optimum rates of fertilizer applications, seeding rate and spacing of dry-land lucerne have been established but no yields have been taken as yet.

(h) Irrigated Pastures: Lucerne has again proved to be by far the most promising pasture crop under irrigation, but cocksfoot/clover and Ronpha have done well. The latter is extremely unpalatable, though, and work on it is being discontinued to extend work on lucerne. In a trial investigating the phosphate and potash requirements and optimum seeding rate of irrigated lucerne only three cuts have, as yet, been taken, and trends are not yet clear. Top yields have been over six tons dry matter per acre in the three cuts to date.

Investigations to determine optimum plot size indicate that provided results are only used for treatment comparison plots of 1/693 of an acre are sufficient, but that over-estimation of yield may result if used for deduction of yield per acre. Indications are that for irrigated lucerne plot size may be further reduced.

(i) Water Relations. In the run-off plots there has been more run-off and soil loss from the bare plots than from any other treatment since the experiment started. The only other treatment to show significance (in the 1958-59 season) was that subjected to autumn burning.

Lysimeter studies show that more water percolates to 4 ft. under fertilized maize than under Bambatsi with or without fertilizer and that overall percolation on granite sand is greater than on the red schist soils.

THE SABI VALLEY EXPERIMENT STATION

W. H. WILLIAMS, *Officer-in-Charge*

GENERAL

The greater emphasis on detailed and fundamental work on water requirements and the effects of water and crops on soil conditions was maintained, and considerable progress was made. Close liaison between field and laboratory remains a feature of the work; the Agronomy Section continued responsible for land preparation, planting, fertilizing, recording of plant growth characteristics and harvesting of experimental areas, while the Laboratory Section dealt with measurement of soil moisture fluctuation, irrigation applications and with sampling for soil-physical and chemical analysis. In all trials where regular sampling for soil moisture was not practicable, irrigations were based on evaporation data and depth of rooting studies, and the total quantity of water applied per irrigation was noted in each case.

The Animal Husbandry Section was reorganized for more efficient control and, by selection and careful management, progress was made in expanding, for experimental purposes, both the dairy and the sheep units; all livestock continued in excellent condition.

WEATHER

Weather conditions were again favourable for irrigation farming; the rainfall distribution was such that little interference was experienced in the spraying of crops and the application of water to them. Climatic details are given under Agro-Meteorology.

STAFF

The staff position was brought up to strength by the appointment of a Technical Assistant, Animal Husbandry, in December. The Senior Agronomist was away on long leave for three and a half months, from mid-December to the end of March.

FIELD CROPS RESEARCH

Cotton.—The 1958-59 season proved to be an excellent one for cotton; moderate and well-distributed rains allowed for adequate weeding and spraying for insect control at regular intervals, with the result that crop loss was light and staining percentage low. In a farm scale planting, over 3,000 lb. seed cotton per acre were obtained, while on experimental plots some exceptionally high yields of over 5,000 lb. were recorded.

Apart from breeding and selection work carried out on behalf of Gatooma Research Station, fertilizer, spraying, cultivation and water-duty trials were conducted and detailed studies of the insect pests of cotton, under the direction of the Cotton Pests Research Team at Gatooma, were continued.

Marked responses to *nitrogen* and to *kraal manure* applications were obtained in a factorial trial on Acacia soil. Whereas ammonium sulphate at planting and again at first flowers raised the yield by 1,000 lb. over control up to 3,186 lb. per acre, plots receiving 20 tons manure and similarly fertilized with ammonium sulphate yielded at the rate of 3,886 lb. seed cotton per acre.

A large-scale insecticide trial comparing "blanket spraying" (complete cover with 0.25 per cent. Endrin at frequent intervals) with the recommended schedule for commercial control, (viz., 8 applications of 0.25 lb. Endrin per acre) gave 3,338 lb. and 3,177 lb. seed cotton per acre respectively, indicating that the commercial method of insect control was adequate and satisfactory for high yields.

A *depth of cultivation* trial on Acacia soil, carried out by hand labour and designed to measure the effect of soil disturbance to varying depths, gave inconclusive results, which however tended to favour deep ploughing methods. In this trial it is probable that local subsoil waterlogging, which presumably had masked effects in past experiments, did not occur, probably due to the well-distributed rainfall and the light irrigations applied, and it is possible that effects of deep cultivation might be more marked when aeration is a limiting factor.

Yields from certain *strain selection trials* are as follows: In Progeny Trial I, in which 49 lines from U4 strains were compared in small plots, the mean yield (including end plants) amounted to 4,466 lb. per acre and the top yield recorded

was 5,660 lb. from S58/39 as compared with the control yield of 4,885 lb. from G52/36. In Progeny Trial II, in which 49 lines from Albar 51 and BMA stocks were tested, 5,517 lb. seed cotton were obtained from S58/69 compared with 4,617 lb. from G52/36 (these yields also include end plants). And in the Preliminary Variety Trial, 25 varieties gave a mean yield of 3,654 lb. seed cotton per acre with Arkot giving 4,398 lb. and G52/36 and 9L34, 3,571 and 3,265 lb. seed cotton respectively. Unfortunately, although G52/36, the control in these trials, is a high yielding strain, its lint quality is not satisfactory for commercial use; Albar 637 will be issued for commercial growing in 1959-60.

With regard to *insect pests*, particular attention has been given to the distribution and alternate host plants of *Platyedra gossypiella*, the *pink bollworm*, which was recorded on cotton in the Valley this season for the first time. So far *Platyedra* larvae and pupae have been found only on *Hibiscus dongolensis* plants, which observation may prove to be of importance in regard to determining methods of eradicating or controlling this pest.

Maize.—Yields were reasonably satisfactory but not up to the standard of those obtained the previous year when the crop was virtually rain grown; the high proportion of poorly-filled ears may be associated with water status and nitrogen levels which require to be investigated.

A *nitrogen trial* superimposed on various cropping treatments in a rotation experiment, and testing 30, 60 and 90 lb. N as top dressing with uniform basal application of 30 lb. *N*, indicated the need for heavy applications of nitrogen to maize following continuous grain (maize/wheat for three years) giving 18.9, 23.7 and 24.7 bags respectively, whereas comparatively small differences in yields (av. 27.4 bags) were recorded from the same fertilizer applications on plots following three years lucerne.

Maize was used as an *indicator crop* to estimate differences in soil conditions following four different cropping systems, and again substantially lower yields were obtained after continuous grain as compared with those recorded following four years cropping to lucerne, dhal and cotton/sunnhemp.

A repeat of the *nitrogen sources* trial on the same site failed to give significant differences to the various sources of nitrogen applied or to kraal manure, but a significant drop in the soil pH figure was recorded where ammonium sulphate had been used over the past three years.

The maize *variety trial*, which included two open-pollinated varieties, three single hybrids and seven double hybrids, gave a mean yield of 17.6 bags/acre, with a top yield of 21 bags from 58 DH13 (Salisbury material).

Kenaf.—Of the five varieties tested, Cuba 108 and Cubano yielded at the rate of 3,148 lb. and 2,929 lb. clean retted fibre per acre as compared with only 1,828 lb. obtained from "Rhojute", the commercial "variety" used in the country to date. All varieties were planted at 1,000,000 seeds per acre and stem counts at harvest were found to be in favour of the highest yielding strains.

Groundnuts.—Yields were again very poor, not more than 800 lb. shelled nuts per acre being reaped from date of planting and from spacing trials. Although sandy, the tight packing of Sabi soils under flood irrigation appears to be a limiting factor to groundnut production, and basic information on irrigation methods and water requirements is required.

Wheat and Barley.—All rust-susceptible wheat varieties suffered from very heavy stem rust damage, probably associated with more than usually overcast and humid weather; the winter months were abnormally "wet". Insufficient seed of the rust-resistant varieties was available for general planting and yields have been reduced as a result; it is encouraging to note however that a farm-scale planting of the resistant selection from H-2-50 (Angola strain) yielded well at 10.7 bags per acre, and showed negligible rust damage.

Quelea damage was comparatively light and the rat problem was countered by organized and repeated baiting.

Wheat yields following lucerne were good compared with yields in the second year of cash cropping after lucerne, and were substantially greater than yields from continuous grain plots.

A *nitrogen trial* associated with these various cropping systems, indicated the need for substantial fertilizer application especially in the continuous grain plots (where yields in the fourth year had fallen to 3.3 bags) and proved beneficial in the second year after lucerne, whereas following three years lucerne insignificant differences were recorded from basal and top dressing of fertilizer.

Both basal nitrogen and top dressing increased the number of ears per acre at harvest, but yield did not vary directly with number of ears.

Final grading for rust damage on straw samples has not been completed, but it appears that the denser stand produced by heavy nitrogen applications has been accompanied by an increase in rust attack and a consequent decrease in grain size.

In a *nitrogen and kraal manure trial* following groundnuts on Acacia soil, nitrogen applied both basal and as top dressing increased wheat grain yield but it appears that a significant response to manure will not be obtained.

The repeat of last season's *timing of nitrogen* application study was planted at too high a seeding rate with the result that severe early lodging took place under overhead irrigation and no yield differences to times of application were apparent.

Following the observation made last season that rust damage and lodging appeared less serious where wheat was planted in 12 inch rows, the *variety trial* was dsigned to compare seven varieties of wheat at both 6-inch and 12-inch spacing. Response to increased spacing varied with variety. The top yield of 12 bags/acre was produced by a selection from the Angola strain H-2-50, at 12-inch spacing between the rows; yields of the standard variety, Burbank, were 8.0 bags and 6.9 bags at 6-inch and 12-inch spacing respectively.

Over 60 varieties and selections of *wheat* were planted for further selection and seed increase; observations made on these are being examined and the best lines will go into the 1960 variety trial.

Barley. The top yielding variety was again Atlas (California) at 21.4 bags/acre; the experiment included five varieties and gave a mean yield of 17 bags. Grain quality was not high probably due to humid weather during the ripening period.

Lucerne. Caliverde lucerne established in the rotation trial on Class B soil (Mopani) continues to yield well in its third year except on the heavier soil areas towards the Class C block.

On Acacia soil there has been no measureable yield response to applications of phosphorus and potassium, which is in line with the belief that response to superphosphate in the presence of lime, observed in previous years, was due primarily to the sulphur supplied in the single superphosphate. Further work in this regard has indicated increased yield to applications of gypsum and to magnesium sulphate but not to calcium chloride; this again suggests that the response is to sulphur, and a more critical trial had been laid down to study this aspect of amendment requirement for lucerne.

The *times of cutting trial* is starting to yield interesting results but will require to be continued for some time longer before comparative yield figures are available. One treatment involves the taking of two seed crops in the second and third winters; the first of these crops taken was extremely poor and it is evident that more information is required on irrigation technique for lucerne seed production.

LABORATORY AND SOIL RESEARCH

Investigations have continued and intensified regarding the relationships between soil, water and crop production under irrigation on the various soils in the experimental area.

SOIL STUDIES

(a) *Effect of crops on soils*. In the Acacia "structure" trial, the development and yield of indicator crops has been studied, and soil samples taken after the four year differential cropping period have been further analysed. Due to large variation of soil conditions within plots, little indication of response to previous treatment was observed except with maize where lower yields were obtained following continuous grain as compared with other treatments; the emergence of maize also was significantly lower following continuous grain.

The organic carbon content in the 0-12-inch depth showed a mean value of 0.42 per cent. following dhal compared with 0.35, 0.33 and 0.33 per cent. for lucerne, wheat/maize and cotton/sunnhemp plots respectively. However, after three indicator grain crops had been taken, the increased organic content on the ex-dhal plots had disappeared.

In the Mopani rotation trial also, after three years of lucerne the organic carbon of the 0-6-inch layer was found to be 0.60 per cent. which was significantly greater than 0.51 per cent. after three years of continuous grain cropping.

(b) *Methods of measuring soil water concentration.* The carbide method has given satisfactory results, and a calibration curve has been prepared to convert water content as indicated to actual percentage on the dry basis for Acacia soils. This apparatus is of value particularly for quick tests in the field.

WATER STUDIES

A report has been prepared on the distribution of the water pumped into the main canal with particular reference to water use on the Development Farm; considerable seepage has been measured from the unlined canals.

The night storage dam has been calibrated; the loss of water from this dam following deepening and due to overflow, seepage and evaporation, has now fallen from 31 per cent. to about 10 per cent. of the volume of incoming water.

Water table investigations using piezometers installed to a maximum depth of 40 feet show that no water has been recorded except in two cases bordering canals.

IRRIGATION EFFICIENCY

Tests have been confined to surface irrigation methods. The overriding importance of grade on the efficiency of surface irrigation has been demonstrated on Acacia grade plots. For maize the total water retained on plots of 400 foot length irrigated with a three cusec stream per 15 foot width was 25, 19 and 10 inches for 1:500, 1:350 and 1:200 grades respectively, and reducing the flow rate only increased slightly the amounts retained. Whereas furrow irrigation greatly reduced the amount of water retained, weed growth substantially increased the water required irrespective of grade.

For *wheat* the total water retained using a three cusec stream was 35, 28 and 22 inches for the above grades respectively; in addition to these irrigations a land preparation irrigation when the ground was covered with broken stover applied 11, 10 and 5 inches for a three cusec stream.

At harvest, the weight of straw showed a marked negative correlation and the yield of grain a positive correlation with the total depth of water applied. The reason for this may be explained as follows: the heavy applications retained on the 1:500 grade-plots may have resulted in a severe leaching of nitrate which would be reflected in the reduced vegetative growth on these plots. On the other hand, where over-irrigation did not occur on the 1:200 grade-plots, the tall, dense straw was associated with a greater incidence of rust which may be the cause of the lower grain yields on these plots.

Irrigation studies on Class C soil on 1:500 grade have demonstrated the importance of infiltration rate on the depth of water retained during irrigations; the average three-inch infiltration time on this soil is approximately 200 minutes compared wih 20 to 30 minutes for Class A soil.

On these plots, *maize* received five irrigations. When flat planted, 16 and 15 inches of water were retained for applications of 3.0 and 1.5 cusecs per 15 foot width respectively; for furrow irrigation, on the other hand, the water required was reduced to 12 and 10 inches respectively for the streams used.

Cotton received seven irrigations; 22 and 16 inches were applied to flat planted cotton and 17 and 15 inches to furrow irrigated cotton for the 3.0 and 1.5 cusec streams used respectively per 15 foot width of border.

The winter wheat crop received nine irrigations of which the last was in preparation for the following crop. If this last irrigation is excluded, the water retained by flat irrigated plots was 21 inches for both 3.0 and 1.5 cusecs per 15 foot width. Where small corrugations at 24-inch spacing were used, the amount retained was 25 and 19 inches for the above flow rates respectively.

SOIL WATER STATUS AND CROP PRODUCTION

Cotton showed a marked yield response to frequent irrigations although the season had well distributed rains. Irrigation when the soil water suction at nine inches reached 0.5 atmosphere gave a yield of 4,000 lb. seed cotton compared with 2,900 lb. for irrigation at 1.0 atmosphere. Plant development studies showed marked differences in heights and branching habits.

Frequent irrigation of *lucerne* gave good yields during the dry, hot period but resulted in a rapid reduction in vigour in the wet season; this is attributed

to non-pathogenic root rot due to waterlogging. Lucerne receiving only infrequent heavy irrigations survived the difficult summer months in much better condition.

Wheat (var. Selkirk) showed no response in grain yield to different irrigation frequencies, but the straw weights increased substantially when the maximum tension at 9-inch depth between irrigations was reduced from eight atmospheres to 0.5 atmosphere.

AGRO-METEOROLOGY

The Agro-Meteorological Station is now well established and a large amount of data is being collected.

During the season under review, the rainfall was about average and well distributed; 17.6 inches of rain fell over the October to March period as compared with 23.5 inches for the same period the previous year. October was unusually wet and overcast and, whereas the April rainfall was much below average, the months of May, June, July and August were abnormally "wet". Evaporation from the Australian pan amounted to 93 inches, and over a 50-day period the daily evaporation from the Class A pan recently installed, was 0.87 of that from the Australian pan; this is provisionally attributed to lower night water temperatures. Water losses from Piche atmometers have shown close correlation with the loss from the Class A pan for 27 weekly periods in winter.

The precipitation deficit (evaporation less rainfall) was 14.3 inches for the December-February period compared with 3.7 inches for the same period the previous year. The considerable difference in these figures was reflected in the need for more irrigations and the absence of severe waterlogging. The yearly precipitation deficit for 1958-59 was 72 inches with a monthly maximum of 10 inches in November and a minimum of 3.8 inches in February.

GWEBI AGRICULTURAL COLLEGE

DR. W. L. FIELDING, *Principal*

INTRODUCTION

The College year ran as usual from October to the end of July. A feature which is not commonly appreciated is that Diploma Day, when diplomas, trophies and other awards are officially presented, is now held at the beginning of a new College year, and not at the end of the year as in the early days. The reason for this is that since the expansion of student numbers in 1955 it was found impossible for examiners to mark papers within a sufficiently short period to keep students, who had virtually finished their course, satisfactorily engaged at College. It has been found far more suitable to have the Leavers' Dinner and End-of-Year Dance closely following the last examinations, and to permit students to go down then. Many students have not done their military training before coming to College, and through an excellent liaison which has been built up with the Defence authorities, these go straight away to do their training. These men then return to College in October to attend Diploma Day, and the College would like to express its appreciation of the co-operation of the Central Africa Command in making this possible each year.

Diploma Day at Gwebi has become an event of note which many friends of the College like to attend, as well as parents, and perhaps they do not all realize that in the Great Hall are seated men of three courses, the men who have left, but returned to receive their diplomas, and those of the present Second and First Years. A most important feature of this development is that the First Year students have the opportunity of seeing the ceremony within a short while after arrival at College, of sensing at first hand something of the tradition which has been established, and of seeing what there is to aim for in their time at College. It has become traditional, for reasons of space, to invite only the parents of those receiving diplomas, and of present Second Year students, but even so it has become difficult to accommodate each year all those friends of the College who would like to come. The parents of First Year students have, of course, two further opportunities of invitation during their son's life at College.

In the year under review, Diploma Day was held on 15th October, 1958, and the Guest of Honour was E. B. Evans, Esq., O.B.E., President of the Rhodesia National Farmers' Union. Mrs. Evans presented the diplomas and other awards.

EDUCATION

Course No. 9 passed out of the College in July, 1959. The standard of work was again of a high level, the results including 12 first class diplomas, carrying 17 distinctions, and 17 standard diplomas, carrying 1 distinction. The latest appraisement is that since the College opened in 1950, 81 per cent. of the students who have sat the Final First Year Examinations have qualified for the second year of the Diploma Course, and of the Second Year students who have sat the Final Second Year Examinations, 88 per cent. have been awarded the diploma. Since the introduction of first class diplomas in 1957, 38 per cent. of those sitting the Final Second Year Examinations have qualified as First Class students. Whilst examining is mainly internal, so many people are involved in awarding marks in the various spheres, in written and practical work, that the system is judged to be thoroughly satisfactory for the type of course involved, and a definite value can be attached to the Gwebi Diploma and other awards. Since the establishment of the College the present Acting Director of Research and Specialist Services, as an external observer, and the Principal of the College, have jointly conducted lengthy oral examinations of all Second Year students, of a general nature, and have judged the standard achieved as very satisfactory and, if anything, improving throughout the years. The results achieved by all First and Second Year students are discussed at a full Examiners' Meeting which decides whether or not a student has qualified for the Second Year, and whether a Second Year student has gained his diploma, and so on. It is through this system that fairness and the high standard of work and tradition of the College have been achieved.

In commenting in last year's Report on the high level of work, it was stated that observation of the adequacy or otherwise of instructional facilities would be interesting. That a high level has been reached is a tribute to the keenness

and output of staff. It is felt, however, that facilities, including provision of staff, have been strained to the limit. Certainly no increased intake could be envisaged without increased facilities, and even with present provision there is a danger of staff efficiency suffering from overwork with eventual deterioration in the College standards. Gwebi staff have not only fields, animal herds, machines, experiments, and so on, to look after. They also have young students continually on their hands, and their work, therefore, is very different from that of a professional or technical officer at a purely research station, because of the continuous and additional educational responsibilities involved at Gwebi College.

Plans for the provision at Gwebi of facilities for practical instruction in tobacco growing have received the blessing of both the Rhodesia Tobacco Association Council and Federal Ministry of Agriculture. It is hoped that funds will soon be provided for this very necessary development. Not only are the facilities necessary to round off the practical curriculum, but, together with the additional member of staff who would be necessary, a small measure of relief would be given to other spheres of practical work which would be most desirable in view of what has been reported above concerning the present burden on existing staff.

The Natural Resources Board Bursary was established during the year, and provides funds for students who would not otherwise be able to enter Gwebi. The move to establish this Bursary started in the North Marandellas I.C.A., and funds have eventually come from many I.C.A.'s. The winner of the first Bursary is now in his first year at College.

Funds to assist necessitous cases have also come from the "Gwebians" (Old Gwebi Students Association) Bursary Fund, whilst the local Gwebi-Hunyani I.C.A. has recently established its own fund for the same purpose.

An Animal Husbandry and a Poultry Short Course were held during the College Long Vacation. Several women students attended the latter course, and it was not possible to take all applicants, so that a waiting list has been held over for next Long Vacation.

DEVELOPMENT

Once again, due to lack of funds, development has been of a minor nature, and involving only administrative and farm planning improvements, not involving the use of additional funds.

Education

It seems that once again a growing list of applicants for entry will force a further measure of expansion in due course. Accommodation of educational (lecture hall, etc.) and residential (student hostel, staff quarters, etc.) types will be necessary. Additional staff will be needed. Detailed plans for these are now in preparation. It is vital that adequate funds are provided or the standard of instruction will fall off, with resulting frustration and strain for staff and dissatisfaction of students. If the latter occurred, it would take a long time to restore confidence, and therefore the provision of adequate funds is essential.

Field Husbandry

Mention was made last year of the planned introduction of grass leys to the Gwebi South rotation. This was commenced this season, with varying success in the establishment of the initial leys. An interesting observation was that germination of grass seeds and/or survival under narow row (3 feet 4 inches) maize was somewhat better than that under wide rows (6 feet 8 inches), and the use of wide rows will be discontinued in future ley establishments. Lack of funds has restricted the establishment of water-points and fencing, which are essential for the full integration of the animal factor.

Investigations revealed that the greater proportion of Gwebi South possesses the undesirable "t" factor and that the land class varies from II to IV w. This is interesting because the farming world has always regarded the College as situated on soils which were easy to farm. Obviously this has been a complete misconception, for the farm provides, generally speaking, an excellent exercise in the handling of difficult soils.

In anticipation of the eventual provision of funds for tobacco growing, the seed-bed site has been fenced and established to Love Grass.

The completion of tree felling in the farmyard area made it possible to establish a new holding paddock with Rhodes Grass, which is particularly convenient for young stock.

The lecturer in Farm Management has initiated some interesting investigations into maize harvesting and other field management problems. This new approach was enthusiatically supported by the Second Year students during their Field Husbandry practical periods.

Due to lack of funds there have been no developments in the sphere of equipment. The greatest credit is due to the staff who have kept an old range of machinery in operation, and this achievement "gives the lie" to those farmers who suffer under the misconception that because Gwebi is a Government College, it has unlimited funds for the purchase of machinery.

Animal Husbandry

Apart from the rebuilding of the pig deep litter courts, on a more satisfactory basis, no development was possible because of lack of funds.

In the Poultry Plant the new Californian-type house for laying hens was modified to suit Rhodesian conditions, and proved a very successful type of accommodation for the birds during the year. In view of this, and the interest of the public in this type of poultry housing, some materials available from obsolete constructions were put to good use in the building of a second Californian-type laying house.

Engineering and Building Construction

Satisfactory development at small expense has been achieved with educational aids such as cut-away models, a model of a borehole installation, wall charts, and a section of a power line. The brick-making machine transferred from Prisons Department has enabled the College to develop brick-making instruction. The College soils are difficult where brick-making is concerned, and the putting into operation of the somewhat dilapidated machine, with difficult materials, is providing valuable instruction for students. Two further blocks of semi-detached housing were constructed in the new village for African employees. This work absorbed most of the funds available to purchase materials for practical building instruction of students.

Estate

A moderate amount of the tree-planting continued in pursuance of the policy of beautifying the College precincts where possible.

PRODUCTION.

Rainfall at the Principal's residence, where records have been kept from 1912, was 38.38 inches, compared with the forty-five year mean of 32.37 inches. The total was, therefore, again above average.

Peculiarities of the season were rains in September and October, a very hot January and February, and the abrupt ending of the rains in March. In this connection the reader will no doubt find interest in the weather table published below under the Research (Field Husbandry) portion of this report. This records data from the weather station on Mundy North, some half-mile to the east of the Principal's residence, and where total rainfall, 37.11 inches, was less, although distribution was much the same.

The season generally was good for crop growth, whilst grasses got away to a good start. The October rains enabled early seed-bed preparation and early planting. Good growing weather was experienced in December, but the first half of January was very wet, tending to retard growth. The second half of January was comparatively dry and sunny, and conditions generally good for crop growth. February, however, was generally cloudy, with numerous showers and a few heavy falls.

Field production included:

Crop	Acres	Production	Yield/acre
Maize Grain (Broadbalk)	79·0	1,964·5 bags	24·87 bags
Maize Grain (Gwebi South)	165·0	3,072 bags	18·62 bags
Maize Grain (Experiments, Mundy North)	—	160 bags	—
Maize Silage	32·0	451 tons	14·09 tons
Sunflower (seed)	—	112 bags	—
Groundnuts (unshelled)	3·5	26 bags	7·43 bags
Potatoes	2·0	161 bags	80·50 bags
Velvet Bean Seed	5·0	25·75 bags	5·15 bags
Soya Bean Seed	5·0	15·75 bags	3·15 bags
Ration Beans	10·0	29·25 bags	2·92 bags
Velvet Bean Hay	16·0	3·56 tons	0·22 tons
Soya Bean Hay (estimated)	52·0	47 tons	0·90 tons
Sudan Grass Silage (Acton pit) (estimated)	—	75 tons	—
Velvet Bean Silage (estimated)	12·0	60 tons	5·0 tons
Veld Hay (estimated)	—	90 tons	—
Potatoes (Experiments)	—	100 bags	—
Giant Rhodes Grass Seed	—	240 lb.	—
Pigeon Peas (Dhal) Seed	—	4·5 bags	—

The maize yield, over the whole area planted to maize on Gwebi South and Broadbalk, constitutes a College record. Velvet beans suffered severely from vine rot and the poor yield of hay compared with silage confirms recent opinion that every effort should be made to use the crop for silage rather than hay.

The Friesland Dairy herd has now completely recovered from the effects of *Vibrio Foetus*, there being 42 cows in milk at the end of the period under review. Recent pregnancy tests have shown over 90 per cent. of the herd to be in calf. The herd average has this year, for the first time since 1955-56, dropped below the 1,000 gallon level, due to the large proportion of first calvers joining the milk herd, namely 11 out of 37 completed records.

The pedigree cow F16, bred by Murray Bros., in South Africa, broke her existing butterfat record during the year, by producing 581 lb. butterfat in a 300-day lactation.

The Poultry Plant produced 10,410 doz. eggs and 4,496 lb. of table poultry.

Revenue from the above production was as follows:

Cash value of field produce sold or fed to African labour, cattle, pigs, sheep and poultry £12,088

Sales of livestock and livestock products (including poultry) ... £12,106

RESEARCH

The first duty of Gwebi College is the education of students. Where possible, however, research is carried out and this is regarded as particularly important in satisfying the aspirations of members of the professional staff, in finding answers to College Farm problems, and to teach students to understand the difficulties of research and the need for it. Due to restricted funds, particularly where staff establishment is concerned, however, only limited research is possible.

Field Husbandry

The Weather: Rainfall and Temperatures 1958/59 Season

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
Inches rain	0·01	—	0·63	2·62	3·07	8·31	8·94	9·77	2·73	0·18	0·22	0·57	37·11
Rainy days	1	—	3	7	10	18	16	23	10	1	2	2	93
Days over ¼ in. rain	—	—	1	5	5	10	8	10	5	0	0	1	45
Mean Maximum	68·6	73·1	81·5	81·3	83·7	81·2	79·7	76·7	78·6	79·2	78·7	71·4	
Mean Minimum	39·6	42·1	53·5	56·0	61·4	61·5	60·5	60·6	57·0	53·0	58·5	43·7	
Mean Temperature	54·1	57·6	67·5	68·7	72·5	71·4	70·1	68·6	67·8	66·1	63·6	57·5	

Maize Varieties. As previously, a number of varieties and hybrids were compared at the request of Salisbury Experiment Station. The open-pollinated varieties proved greatly inferior to all hybrids, in grain yields. Some of the new hybrids were considerably better than S.R. Hybrid No. 1, in particular No.

58 H.1. Hybrid No. 58 H.3 had a noticeably high proportion of grain : stover. It was short, growing only to 6-7 feet, and produced very large cobs. Should combining of maize increase in importance in the Federation, this type of plant would prove most useful. On the other hand, 58 H.1 had a noticeably high total plant material weight, indicating a high potential silage yield, and is therefore likely to prove a useful dual purpose type. Although *Helminthesporium turcicum* infection was generally light, the two new hybrids mentioned above showed considerable resistance to the disease, this being a further indication of potential usefulness. Although rust, too, was generally light, 58 H.1 showed good resistance to *Puccinia Sorghi*, whilst 58 H.3 was more susceptible. Root lodging was insignificant in both the above hybrids, but whilst 58 H.1 showed little stem lodging, 58 H.3 was rather weak in this respect.

Nitrogen and the Maize Plant. No response to nitrogen was found in one experiment designed to compare ammonium sulphate, urea and nitrolime applied at different rates. None of the treatments had any significant effect in a further experiment designed to study the effect of plant populations and different rates of application of ammonium sulphate placed in different ways. Studies of the residual effect of nitrogen, and the addition of further nitrogen to maize following a managed and fertilized grass ley, were continued. It was found that, whilst residual nitrogen gave a slight increase in yield, this was negligible and not of any practical importance in view of the very considerable increases obtained by applying nitrogen to the growing crop.

Potatoes. The yield of certain potato varieties under summer rainfall conditions, and particularly their reaction to early (10th November), medium (11th December), and late (3rd January) planting, and to fungicide application, was studied. A general reduction in yield, with lateness of planting was found. The response to fungicide, applied in connection with late blight control, varied with time of planting. *Pimpernel*, for instance, gave a good response at all dates; *Up-to-Date*, early planted, gave no response, mid-season planted a slight response, and the late-planted crop an outstandingly good response to fungicide. In view of the consumer resistance to yellow-fleshed potatoes and the somewhat unwieldy size of the white-fleshed blight resistant *Walanga*, it is still important to see if late blight control can be effected in the former favourite, white-fleshed *Up-to-Date*. and the work will be continued next season. In all cases there was a close correlation between rate of development of late blight and yield of potatoes.

Soya Beans. As previously reported, the College regards this plant as the most suitable for legume hay, and a search is constantly made for even better varieties than those available from Salisbury Experiment Station. This year's critical trials have shown that this search has so far been in vain and also demonstrated the need for a variety of long growing period, in view of the fact that all local strains have yielded better early planted than when they were late planted. Depending on the weather, however, it is not always possible to make good hay from these when early planted because of their short growing period. Further efforts will be made to obtain the required material from other countries.

Lucerne. A federal lucerne trial was established under dry-land conditions.

Pastures. The Fertilizer Grazing Trial, commenced on veld in 1953-54, was continued. The six seasons' results have shown that fertilizing veld has two main effects:

(a) the liveweight gain/acre of cattle is markedly increased;

(b) the species composition of the veld is altered. This change is very obvious to the eye, and a detailed botanical analysis will be carried out next season.

A new treatment consisting of seven acres of Katambora Rhodes grass and Horse Marmalade *(Demodium discolor)* was laid down adjoining the grazing trial, for liveweight gain comparison with fertilized veld.

Animal Husbandry

Economic Beef Production. The third trial in this series, which was mentioned in last year's Report, is nearing completion and will be fully reported next year. The fourth trial has commenced, the breeds represented being Aberdeen Angus, Africander, Nkone and Tuli.

Sheep. A study involving the lambing down of Blackhead Persian ewes twice a year has shown that a lambing percentage in excess of 150 per cent. can be

maintained over three years. The heavy demand of almost continuous pregnancy while nursing a lamb at foot, however, necessitates a high level of supplementary feeds in winter.

Pigs. The College continued to submit piglets to the Litter Testing Station, for progeny trials.

Feeding Legume Silage to Steers. Owing to the heavy field losses of protein experienced in making legume hay, attention has been focussed on the feeding of legume silage. Although this may be practised by farmers in some parts of the country, it is not a common practice in Mashonaland, and little factual information concerning the practical feeding of legume silage is available. In this trial steers took up to 55 lb. per day of velvet bean silage, and the data obtained will be of considerable use in farm practice and for student instruction.

Poultry. Work on the production of hybrids is continuing. During the hatching and rearing of inbreds, a lethal appeared in one family giving 80-90 per cent. mortality.

Engineering

Methane Gas. Early trials have shown this to be not suitable for engine use, but it is believed there is considerable potential for this gas, manufactured from manure, for use as a source of light in African villages. A larger unit, designed to operate four lamps for four hours daily has been completed, and will be assembled and tested at the Gwebi College School for children of African employees.

Producer Gas. A second model, with supercharger, fitted on to an old Massey-Harris tractor, worked much better than the earlier model fitted to an old Fordson. Excessive tar production appears to be a problem when using maize cobs instead of charcoal.

Kenaf Harvester. Insufficient was known about decorticating and the nature of the crop and the machine was abandoned as unsuitable.

Testing and Construction. A limited amount of machinery testing was done, and assistance in design and contruction was given to other Stations and Sections.

PUBLICATIONS

"Field Crop Experiments at Gwebi", a progress report by J. R. Tattersfield, Lecturer in Crop Husbandry, was published in the Rhodesia Agricultural Journal, Vol, 56, No. 1, 1959, and is available as R.A.J. Bulletin No. 1977. A memorandum, "Research at Gwebi Agricultural College, 1950-59", was written by the College staff.

TOTAL REVENUE

During the financial year ending on the 30th June, 1959, revenue from all sources at the College, including student fees, was £27,881.

REPORT OF THE FEDERAL DEPARTMENT OF CONSERVATION AND EXTENSION FOR THE YEAR ENDING 30th SEPTEMBER, 1959

C. A. MURRAY, *Director*

SOUTHERN RHODESIA

1. ORGANIZATION

The organization of the Department remained essentially unchanged during the year.

(a) *Head Office.* After an upgrading of the post of Vlei Drainage Engineer and extensive advertising, a suitable applicant was found who took up his appointment on the 1st October, 1958.

The absence of the Chief Conservation Engineer overseas on a study tour made it necessary for the Senior Research Engineer, who is normally based at Henderson Research Station, to spend a very large percentage of his time at Head Office carrying out the former's duties in addition to his own.

To streamline the organization it was found necessary to make the Senior Planning Officer entirely responsible for all planning work in both Northern and Southern Rhodesia, but he continues to operate under the general control of the Chief Planning and Training Officer. Due to the great pressure of work in the Planning Section at Head Office, especially in regard to in-service training of field officers and holding of short courses for farmers and others, it became necessary to use another post on a temporary basis to assist with the Department's work until an additional post is approved on the establishment.

(b) *Regional Offices.* It was found necessary during the year to appoint an African clerk/typist permanently to the Regional Office in Bulawayo to assist the European clerk there. Each of the Regional Offices has a European male clerk and two of these are on the permanent establishment.

Due to the great pressure of work in the Mashonaland Regional Office, authority was obtained to appoint a Conservation Assistant (scribe) to assist the Agricultural Topographer in farm planning, tracing and the preparation of maps generally.

All Group Offices now have either part-time or full-time clerical assistance—a fact that has helped very much to increase the time that individual professional officers are able to spend in the field.

(c) *Intensive Conservation Areas.* The position in regard to Intensive Conservation Areas can be summarized as follows:

(i) Declared during the year: Nil.

(ii) Investigated or under investigation for declaration: Nil.

(iii) Subdivided during the year: Nil.

(iv) Investigated or under investigation for subdivision: Nil.

(v) Boundaries changed: Horseshoe, Umvukwes, Darwin, Norton, Salisbury South, Insiza, Essexvale, Macheke and Headlands.

(vi) Investigated or under investigation for boundary changes: Figtree, Marula and Plumtree.

(vii) Total number of areas declared: 93 I.C.A.s have now been declared in Southern Rhodesia.

The position in regard to I.C.A.s, Groups and Regions is now as follows:

Region	*Group*	*I.C.A.*
Mashonaland . . .	Salisbury	Gwebi-Hunyani
		Salisbury West
		Norton
		Salisbury South
		Arcturus
		Ruwa
		Beatrice
	Marandellas . . .	Wenimbi
		Marandellas South
		Wedza
		Bromley
		Marandellas North
		Marandellas West

Region	*Group*	*I.C.A.*
	West Hunyani	Angwa South
		Angwa North
		Doma
		Karoi North
		Karoi South
	East Hunyani	Darwendale
		Trelawney
		Banket
		Eldorado
		Ayrshire North
		Ayrshire South
	Mazoe	Umvukwes
		Horseshoe
		Darwin
		Glendale
		Marodzi-Tatagura
		Bindura
		Shamva
Midlands	Gwelo	Gwelo
		Gwelo East
		Selukwe
		Vungu
		Upper Ingesi
	Victoria	Umshandige
		Victoria Central
		Victoria East
		Chiredzi
		Nuanetsi-Mtilikwe
		Sabi Valley
	Charter	Featherstone
		Enkeldoorn
		Gutu
		Umvuma
		Tokwe
		Chatsworth
	Umfuli	Umsweswe
		Suri Suri
		Sokis
		Umfuli
		Selous
		Gadzema
	Que Que	Battlefields
		Umniati-Sebakwe
		Bembezaan
		Sessombi
Eastern	Mid-Eastern	Mayo
		Macheke
		Nyandora
		Mtoko
		Headlands
		Rusape
		Odzi
		Tsungwezi
	Eastern	Inyanga
		Umtali North
		Umtali South
		Cashel
		Melsetter
		Chipinga
Matabeleland	Gwaai	Bubi
		Inyati
		Lower Umgusa
		Upper Umgusa
		Lower Khami
		Upper Khami
	Shangani	Mchingwe
		Insiza
		Shangani
		Ncema
	Umzingwane	Gwanda
		South Matopos
		Filabusi
		Belingwe-Shabani
		Limpopo
	Western	Figtree
		Matopos North
		Marula
		Plumtree
		Gwaai
		Matetsi

(d) *I.C.A. Committees.* A tremendous amount of good work was done by I.C.A. Committees during the year in promoting an interest in conservation generally and in attending to their numerous responsibilities. They sponsored field-days, took an interest in field trials, organized and administered bilharzia and liver-fluke spraying in their respective areas, in addition to manifold other tasks associated with conservation in its broadest sense.

A most progressive step, which will undoubtedly have very beneficial consequences, is the decision by the I.C.A. Conference that committees should operate on the ward system wherever possible. In many areas this decision has already been implemented with good results.

(e) *Group Organization.* The group organization is gradually increasing in strength and in those areas where an energetic Group Committee is in being, fulfills a most useful function as a co-ordinating body between not only the individual I.C.A.s themselves, but also between the I.C.A.s and this Department, as well as other organizations such as the Road Council and Farmers' Association of the area and local representatives of the Roads Department and other Government bodies.

2. STAFF

(a) *Establishment.* The only change in the establishment that took place during the year was the authorization of an additional Conservation Officer's post that had been requested specifically for the newly created Horseshoe I.C.A.

On the upgrading (from P.O. to P.O. + P.O. Special) of the Irrigation Officer's vacant post at Gwelo during the period under review, a suitable applicant within the Department itself came forward and took over the position at the beginning of April, while on the 1st July, 1959, the Senior Irrigation Officer's post was upgraded from S.P.O. II to S.P.O. II + I and filled by the present incumbent. The Chief Conservation Engineer's post was upgraded from £2,350 per annum to £2,450 per annum with effect from 1st November, 1958. Two other upgradings that occurred were those of the Senior Research Engineer (from S.P.O. II to S.P.O. II + I) and the Conservation Assistant at Henderson Research Station, whose grading was changed from Scale C to Scale D (that of Senior Conservation Assistant). The Mechanical Engineer's post, formerly shown as a secondment from the Central Mechanical Equipment Department, was placed on the Department's establishment at S.P.O. II + I level with effect from 1st July, 1959. As the Clerk/Librarian's post was not realistically assessed in the first instance, the post was upgraded from Scale D to Scale E (Branch III) with effect from 1st September, 1959.

The following table gives the establishment of the Department:

	Authorized 30.9.58	*Authorized* 30.9.59	*Requirements*
Administration (including Professional Staff at Headquarters)	16	16	16
Regional Clerical Staff	9	9	9
Regional Conservation and Extension Officers	4	4	4
Additional Regional Conservation and Extension Officers	4	4	4
Group Conservation and Extension Officers	27	27	27
Conservation Officers	84	85	101
Chief Conservation Engineer	1	1	1
Senior Research Engineer	—	1	1
Research Engineer	2	1	1
Farm Machinery Advisory Engineer	1	1	2
Farm Building Advisory Engineer	1	1	2
Vlei Drainage Engineer	1	1	1
Mechanical Engineer	1	1	1
Technical Assistant (Erosion Research)	—	—	1
Draughtsman/Topographer (Engineering)	—	—	1
Senior Irrigation Officer	1	1	1
Irrigation Officer	1	1	1
Young Farmers' Clubs Organizers	2	2	5
Chief Tobacco Extension Officer	1	1	1
Tobacco Extension Officer	1	1	1
Chief Planning and Training Officer	1	1	1
Senior Planning Officer	1	1	1
Senior Training Officer	—	—	1
Senior Agricultural Topographer	1	1	1
Agricultural Topographers	5	5	5
Animal Husbandry Officer	1	1	1
Farm Managers and Assistants	4	4	4
Information Officer	—	—	1
Mechanical Unit Inspectors	6	6	4
Senior Horticulturist (seconded from Department of Research and Specialist Services)	1	1	1
Horticulturist (seconded from Department of Research and Specialist Services)	1	1	1

	Authorized 30.9.58	*Authorized* 30.9.59	*Requirements*
Soil Chemists (seconded from Department of Research and Specialist Services)	2	2	3
Senior African Conservation Assistants	—	1	5
African Conservation Assistants	22	25	21
Senior African Survey Hands	—	—	4
African Survey Hands	116	120	116
African Clerks (Regional and Group Offices)	4	7	8
African Clerk/Librarian	—	1	1
African Scribes	—	1	3
African Orderlies, Drivers, etc.	12	12	12
TOTALS	334	348	375

At the end of September, 1959, there were 41 officers in the Department trained and qualified to advise on tobacco production. Eight new officers were trained during the past season and five are currently undergoing training. The distribution of these men between Northern and Southern Rhodesia is as follows:—

Southern Rhodesia ... 34
Northern Rhodesia ... 7

(b) *Visits to Other Countries.* Through the generosity of certain organizations such as the International Co-operation Administration, the Ford Foundation of the U.S.A., the Food and Agriculture Organization of the United Nations, and the co-operation of the Federal Government, it was possible for certain members of the Department to visit the U.S.A. during the year. In some instances their study tours included visits to agricultural centres in the United Kingdom and Holland.

Experience has shown that these overseas visits are of the greatest possible value to those who have been able to make them and in the interest of the service. The officers concerned who have undertaken these study tours are greatly strengthened in the broad field of agricultural knowledge and techniques and in consequence are of greater value than ever to their colleagues in the Department and to the farmers whom they serve.

Details of individual visits are given below:

(i) Chief Conservation Engineer (Mr. J. M. Cormack) left for the U.S.A. under International Co-operation Administration auspices on the the 12th April, 1959, to study various aspects of catchment planning, land drainage, water conservation and the latest techniques used in bush clearing in addition to a number of other matters pertaining to the particular responsibilities of this post. He is due to return at the end of November, 1959.

(ii) Messrs. J. H. H. Louwrens (Regional Conservation and Extension Officer, Matabeleland), R. R. Graham (Additional Regional Conservation and Extension Officer, Mashonaland) and E. L. G. King (Additional Regional Conservation and Extension Officer, Northern Rhodesia) left for the U.S.A. on the 20th May, 1959, under the auspices of the Food and Agriculture Organization. The objectives of the tours by the last two of these officers may be summarized as follows:

To study, learn and discuss—

(1) Extension methods at all levels, including organization methods, application, evaluation, leadership and publicity.
(2) Modern methods and techniques of intensive dry-land crop production and soil management.
(3) The techniques of livestock management and integration of livestock in workable farming systems in the higher rainfall cropping areas.
(4) Systems of land-use planning based on capability classification and integration of farming systems on an economic basis.
(5) Conservation Education, e.g., Conservation education in schools, 4-H and F.F.A. organizations.

The objectives of Mr. Louwren's visit were essentially the same, except that the emphasis of this tour of the U.S.A. was directed more to the lower rainfall areas than was the case with Messrs. Graham and King.

All three of these officers visited various agricultural centres in the United Kingdom and Holland on the conclusion of their American visit.

(iii) Messrs. V. A. Penberthy (Regional Conservation and Extension Officer, Mashonaland) and N. Beaumont (Regional Conservation and Extension Officer, Northern Rhodesia) left for a tour of the U.S.A., the United Kingdom and Holland

on the 4th March, 1959, under the auspices of the Ford Foundation and returned to Southern Rhodesia on the 16th August, 1959. The objectives of the tours of these two officers were essentially the same as those outlined in the case of Messrs. Louwrens, Graham and King and in addition they attended the intensive training course for extension workers at Wageningin University, in Holland, for a period of one month.

(iv) The Farm Machinery Engineer (Mr. H. A. Templeton) during the period 14th to 30th June, 1959, visited various areas in the Union of South Africa inspecting and studying machinery used in groundnut production.

(v) Messrs. C. K. Thompson (Regional Director, Northern Rhodesia) and F. B. Rhodes (Senior Animal Husbandry Extension Officer, Northern Rhodesia) visited the Belgian Congo during the period 27th to 30th January, 1959, for the purpose of studying agricultural development in the part of the Congo territory that is contiguous to the Copperbelt.

(vi) Messrs. P. Hawkins and G. B. Jones (both Planning Officers in Northern Rhodesia) were granted three months' special study leave to attend a course in soil survey and land classification at Delft, in Holland. Their participation in this course, which started on the 7th September, 1959, did not entail a special journey from the Federation for them as they were already in the United Kingdom on vacational leave when it commenced.

(c) *Departmental Committees.* The Director served on the following Committees during the year:

(i) Federal Standing Committee on Agricultural Production.
(ii) Livestock Improvement Committee (Chairman).
(iii) Natural Resources Board of Southern Rhodesia (Advisory).
(iv) Cabinet Sabi Development Committee.
(v) Water Resources Committee of the Natural Resources Board of Southern Rhodesia.
(vi) Tobacco Research Board.
(vii) National Parks Board.
(viii) Research Advisory Committee of the Department of Research and Specialist Services.
(ix) Conservation Education Committee of the Natural Resources Board.
(x) Field Experimentation Committee (Chairman).
(xi) Council of the Rhodesian & Nyasaland Association of Young Farmers' Clubs.

The Deputy Director served on the:

(i) Land Settlement Board.
(ii) Subdivision of Land Committee of the Natural Research Board.
(iii) General Purposes Committee of the Natural Resources Board.
(iv) Native Affairs Committee of the Natural Resources Board.
(v) Sabi Development Farm Committee.
(vi) Mineral Resources Committee of the Natural Resources Board.
(vii) Bothashof School Council (Government representative).

The Chief Conservation Engineer served on the:

(i) Inter-Departmental Committee on Hydrology.
(ii) Water Resources Committee of the Natural Resources Board.
(iii) C.M.E.D. Co-ordinating Committee.
(iv) Regional Water Development Committee.
(v) Sabi Catchment Advisory Committee.
(vi) Engineering Committee of the Department of Conservation and Extension.

The Chief Planning and Training Officer served on:

(i) Sabi Catchment Advisory Committee (Chairman).
(ii) Nitrogen Committee.
(iii) Marimba Catchment Committee (Chairman).

The Senior Conservation and Extension Officer served on:

(i) The Field Experimentation Committee.

(ii) The Conservation Education Committee of the Natural Resources Board.

(iii) The Conservation Education (Teachers) Sub-Committee of the Natural Resources Board (Chairman).

(d) *Publications.* The Department was responsible for the preparation of the following papers and articles published in various journals and magazines:

	Title	*Author*	*Publication*
1.	Marrow Stem Kale	D. Burks	R.A.J., Jan./Feb., 1959.
2.	Wedza Speeds the Plough	D. Burks	Rhod. Farmer, June, 1959.
3.	South Marandellas Encourages Pasture	D. Burks	Rhod. Farmer, June, 1959.
4.	Tenant Farming, an Answer to Idle Land	C. B. Metcalfe	Rhod. Farmer, March, 1959.
5.	Tile Drainage Helps Poorly Drained Soils	H. D. Leach	R.A.J., July/August, 1959.
6.	Soil and Water Conservation in Rhodesia	C. B. Metcalfe	Journal of Commonwealth Development, December, 1958.
7.	Rural Land Values in Southern Rhodesia	C. B. Metcalfe	Libraries of Chartered Institute of Auctioneers and Estate Agents (U.K.) and American Society of Farm Managers and Rural Appraisers.
8.	Conservation Comment from the Umvukwes I.C.A.	C. Sharman	R.A.J., July/August, 1959.
9.	Some Thoughts on the Mechanisation of Agriculture	H. Templeton	Good Farming, April, 1959.
10.	An Old Reaper-Binder Helps to Make your Sunnhemp Hay	C. B. Metcalfe	R.A.J., July/August, 1959.
11.	The Cost of Earth Dams is Coming Down	M. M. Woodgate	Rhod. Farmer, August, 1959.
12.	Beef Cattle Courses for Farmers in the Federation	V. Vincent	Good Farming, September, 1959.
13.	Purchase and Maintenance Hints on Agricultural Machinery	H. Templeton	Central African Post, July, 1959.
14.	Results Achieved in the Measurement of Erosion and Run-off in Southern Rhodesia	N. W. Hudson and D. F. Jackson	Read at the Third Inter-African Soils Conference in Dalaba in November, 1959.
15.	Conservation Education in Schools	D. E. Baker in collaboration with staff of the Department of Native Agriculture and the Federal Ministry of Education.	
16.	Land Capability Classification	V. Vincent	
17.	Soil Conservation Legislation of the Federation of Rhodesia and Nyasaland and its Application	J. C. Harper in collaboration with the Assistant Secretary of the Southern Rhodesia Natural Resources Board	
18.	Drainage Problems on Arable Lands in the Federation of Rhodesia and Nyasaland	S. Durbach and L. A. N. Robertson	
19.	Tobacco Extension and You	C. Rose	Rhod. Tobacco Review, June, 1959.
20.	Farm Road Construction	J. M. Jameson	Rhod. Tobacco Review, June, 1959.
21.	United Kingdom Grades	C. Rose	Good Farming, July, 1959.
22.	Early Tobacco Gives the Yield	C. Rose	Rhodesia Herald Show Supplement, 1959.
23.	North Eastern Rhodesia Tobacco Press Release	C. Rose	Evening Standard and Northern News.
24.	Editorial Comment on Burley	C. Rose	R.A.J., July/August, 1959.
25.	Turkish Tobacco Bulletin	J. M. Jameson	Rhod. Farmer, Oct., 1958, to May, 1959.
26.	Weekly Tobacco Bulletin	C. Rose, J. M. Jameson and R. R. Graham	Rhod. Farmer, July, 1958, to March, 1959.

The Department, in collaboration with the Department of Research and Specialist Services, was also responsible for having published the September/October and November/December sections of the revised Farming Calendar in the July/August and September/October issues respectively of the *Rhodesia Agricultural Journal*.

3. TRANSPORT

The transport situation remained completely adequate during the year, proving once again that the current practice of allowing officers to use their private cars on official duty is an extremely satisfactory one.

Details regarding the vehicle position in Southern Rhodesia are as follows:—

Authorized private vehicles	...	140
C.M.E.D. vehicles	... ...	21
Outstanding applications	...	4

4. EXPENDITURE

Vote 41	Federal Headquarters and Southern Rhodesia Items	1958/59 Authorized	1958/59 Actual	1959/60 Authorized and Anticipated Expenditure
A	Salaries, Wages and Allowances	250,651	249,731	261,000
B	Travelling and Subsistence	18,300	15,425	19,500
C1	Books and Periodicals	260	236	260
C2	Camping Equipment	50	23	50
C3	Experimental Equipment for Conservation Works	1,760	1,744	3,180
C4	Leave Entitlements	1,000	1,193	1,000
C5	Office and Miscellaneous	1,900	1,630	1,800
C6	Purchase and Upkeep of Instruments and Technical Furniture and Equipment	1,280	1,348	1,650
C7	Recruiting Expenses	600	517	1,300
C8	Teachers-training Courses	200	55	200
C9	Water, Light and Sanitary Charges	1,300	1,538	1,400
D	Housing	12,000	10,719	2,540
E1	Grass Nurseries, Field Trials and Other Conservation Works and Measures	6,350	6,196	8,600
E2	Conservation Works and Measures on European Farming Land in Terms of Section 23 of the Natural Resources Act of Southern Rhodesia — 1941	5,180	5,156	3,250
G2	Chipinga Experimental Farm	5,650	6,276	5,400
G4	Karoi Experimental Farm	7,200	7,050	6,950
H	Transport and Equipment	69,030	65,092	72,850
J	Farm Planning (Air Photography)	3,330	3,245	3,560
K	Assistance to University Students:			
	1. Bursaries	1,650	1,100	1,050
	2. Loans	900	500	650
	TOTAL	£388,591	£378,774	£396,190

5. GENERAL AGRICULTURAL CONDITIONS

(a) *Climatic Conditions—General*

The past summer season, like that of 1957-58, was a difficult one for crop producers, being characterized by a late commencement of the rains in many areas and their early cessation in February or March in certain parts of Southern Rhodesia. The abrupt termination of the rains had an adverse effect on the grazing, which tended to decline in quality earlier in the autumn than usual.

Winter temperatures were mild, the incidence of frost being low.

Details of climatic conditions experienced in each of the four regions are given below:

(i) *Mashonaland:* The rains arrived late, despite some scattered showers in October and were unevenly distributed throughout the region, droughts of three to four weeks duration being a common feature. Total rainfall varied from 15 to 50 inches, the wet weather coming to an abrupt end in February or March, depending upon the locality. Hail storms caused considerable damage to tobacco crops in the Salisbury and Marandellas Groups.

Because of poor initial planting conditions, much of the maize crop had to be replanted, with a consequent reduction in yield.

(ii) *Eastern:* The season began favourably in the mid-eastern areas, with general rains of up to 2 inches in October followed by overcast weather ideal for planting. November, generally, was dry and the wilting of crops was widespread; thereafter the rainfall was erratic until late January, when heavy falls were experienced. The wet weather ceased abruptly in early March.

In the Eastern areas the pattern was much the same and total falls during the year failed to reach the average figures for previous years.

(iii) *Midlands:* The rains arrived later, were erratic and with the exception of a few areas such as Hunters Road, tailed off abruptly in early February. The areas most severely affected by the erratic rainfall were south-west of Gatooma, west of the railway line in Battlefields and in the vicinity of Que Que west of the line of rail. In the latter area most of the maize crops (and even the tobacco) were very poor or failed.

Veld grazing deteriorated early in the season and livestock fell off rapidly in condition in consequence.

(iv) *Matabeleland:* The season was one of the most difficult experienced for many years, being characterized by late rains, very heavy falls during December and January and an early cessation in mid-February. Falls in March were extremely isolated. This had an adverse effect on crop production and the quality of the grazing. Water supplies generally have been adequate, although at the end of the dry season they were very low in some areas.

The winter was relatively mild and the incidence of frost was small.

(b) *Crop Production*

(i) *Food Crops—Maize:* In those areas in which favourable early rains were experienced, very good crops of maize (in the vicinity of 20 bags per acre) were reaped, but by and large the unfavourable distribution of the rains depressed yields in the crop-producing areas at large. Erratic falls at the beginning of the season necessitated replanting on many farms. Maize planted late in the summer gave most disappointing yields.

The standard of management was commendably high in the more progressive areas and there is distinct evidence that farmers are heeding more and more the advice of the Extension personnel of this Department in matters related to the production of the crop.

Except for maize streak (caused by Zea virus 2) in the Umgusa Valley and a small amount of *Diplodia*, the incidence of disease was generally low. Pests, too, did not cause much damage.

Sorghums: In the Midlands some excellent crops of sorghums were grown—one farmer in the Fort Victoria area averaging 13 bags of grain to the acre. The rather dry summer was probably responsible for this result, which may encourage more farmers to grow this drought-hardy crop during the coming season. Radar and Haakdoorn were the only two varieties grown in the Midlands during this last summer, the latter mainly for silage purposes. There is still an interest in sorghums for grain on the heavy basalt soils of western Matabeleland, but only two farmers planted on a large scale.

Practically no sorghum was planted in Mashonaland and in the Eastern Region during the year.

Groundnuts: Despite the great potential that exists in Southern Rhodesia for the production of this crop, the overall acreage established to groundnuts on European farms during this past season was very small. The yields achieved were disappointing in the majority of cases due, principally, to insufficient attention being devoted to the necessary cultural practices involved.

Other Legumes: Small crops of various types of beans were grown on a great many farms, principally for Native rations, but also as a source of protein for animal feed. Special mention should be made here of jack bean (*Canavalia ensiformis*), which has given such excellent results at Henderson Research Station and on many farms in Mashonaland where it is grown for its high content of digestible protein. Unfortunately, this particular species has not done as well as had been hoped in the Midlands during this past season.

Potatoes: A very marked increase in the acreage planted has taken place in the Midlands during the last 12 months, where the results have been satisfactory on the whole. Much capital has been invested in overhead irrigation equipment for winter production in this area—particularly in the Gwelo Group. In Gwelo itself a Potato Producers' Association has been formed through which all locally produced potatoes are sold by the Matabeleland Farmers' Co-operative.

Both the dry-land and irrigated crops grown in the Salisbury Group yielded well during this last season and the acreage involved was slightly higher than last year. In the Eastern Region commercial summer potatoes were disappointing—primarily due to eelworm, but in the higher lying Eastern areas good seed crops were produced despite an attack of late blight in early January. In Matabeleland there has been a small increase in production of potatoes grown under irrigation and yields have been fair to good.

The effects of disease (particularly late blight) appear to have been less marked this year than might have been expected—due, in large measure, to the season and the use of disease-resistant varieties.

Wheat: Except in one or two instances, only small acreages of this crop were grown under irrigation during this past winter and yields generally have been disappointing except in the Umshandige Valley where the crop promises well. The area under wheat on this particular irrigation scheme is higher than it has been for several years.

A negligible acreage of summer wheat was grown during the season.

Barley: This crop continues to be a more popular one than wheat in many parts of the country, where it is grown primarily under irrigation for sale to breweries. In the Eastern Districts, in the vicinity of Chipinga, yields of up to 12 bags per acre were obtained.

Vegetables: With the exception of the Eastern Districts, where three canning factories exist, vegetable production in other parts of Southern Rhodesia is confined principally to the vicinities of important markets such as Salisbury, Gwelo, Bulawayo and large employers of labour, of which the Wankie Colliery is a good example.

During the year tomatoes maintained their position as one of the most important fresh market cash crops (and as a canning crop in the Eastern Districts) and production in many instances in the Eastern Region was greater than in the previous year.

Peas remained the main winter vegetable crop in the Eastern Districts, where a greatly extended acreage was planted during the past season. Yields were not up to expectations due, principally, to adverse weather conditions coupled with different times of planting.

Difficulties encountered in disposing of last year's onion crop has brought about a decline in this season's plantings in the Eastern Districts. In this area there has been an increased production of cabbages and brussels sprouts during the season, yields of up to 15 and 5 tons respectively having been obtained. Cauliflower yields of 4 tons of curd to the acre were lower than had been expected —a fact attributed to the use of an unsuitable strain of seed.

Fruit—Sub-tropical: There has been a steady increase in plantings of citrus in the Eastern Districts (particularly of late varieties) and in the Midlands and a small development of banana production has taken place in the Victoria lowveld. An increased production of papaws in the Cashel area has occurred and the new variety Hortus Gold produced there and elsewhere in the Eastern Districts has been well received by both the local canning factory and the Salisbury market. The expansion of banana production generally has been disappointingly slow due, possibly, to the fact that potential growers in Burma Valley (an area very well suited to the production of this crop in Southern Rhodesia) have temporarily diverted their attention to the growing of tobacco.

A great deal of the sub-tropical fruit consumed in this country is still imported from Portuguese East Africa, where climatic conditions are ideal for the production of mangoes, pawpaws and bananas.

Deciduous: The Eastern Districts, in which the bulk of Southern Rhodesia's deciduous fruit is grown, had a favourable season for the production of many different varieties. The crop of Methley plums was of record proportions, the supply of canning peaches (mainly Kakamas) was much greater than in previous years, and apples, although rather small in quantity, were markedly improved in quality. Apricots did not yield as well as had been hoped, freckle and bird attack causing considerable damage, as did the phenomenon of splitting where Captan sprays were not used.

An expansion in viticulture has taken place in the Cashel, Umtali, Rusape and Mayo areas. Over a 1,000 gallons of wine were produced in the Rusape Group during the year, its reception on the market being most encouraging.

Elsewhere in the country the position in regard to deciduous fruit production has been static.

(ii) *Cash Crops: Flue-cured Tobacco Seed-beds:* Further general improvement was recorded in seed-bed management in all areas. The use of methyl bromide showed a steady increase over last year, seeding rates came down, management—particularly in regard to watering—showed steady improvement, hardening off of seedlings was better and all this resulted in a good supply of suitable seedlings for planting out in October. The standard of spraying was higher than last year and

although anthracnose was again the most serious disease in seed-beds, the disease was held in check. With certified seed now available, adequate spraying with effective fungicides and greater attention to hygiene, there is little reason for this disease to assume the alarming proportions which threatened tobacco growers a few years ago.

With improved management, some farmers have found that a seeding rate of one ounce of seed to 500-600 square yards instead of the recommended 1 oz./400 sq. yards has given good results.

However, with all the advances made, farmers are still too casual about mosaic control. Smoking in the beds is not uncommon and many farmers still use a bucket of water treated with a disinfectant as a control measure against this disease. This practice in most cases provides one of the most effective ways of spreading the disease throughout the beds, particularly if any weeding has to be done.

It is interesting to note that mulching, virtually unknown three or four years ago, is now a country-wide practice.

Land Selection: Farm planning has simplified this most important phase of the crop. Pit examination to determine the suitability of soil for tobacco, the time the soil should be ploughed and fertilizer applications is rapidly becoming an accepted practice by farmers. More and more farmers are planning their farms in order to be able to grow a fixed acreage of tobacco on the best soils available. Increasing difficulty is being experienced by farmers who grow tobacco on the heavier soils and on those soils with markedly heavier subsoils, and it is becoming more apparent that the more the soil differs from the ideal tobacco soil, the more difficult and hazardous tobacco growing becomes.

Land Preparation: A marked improvement in the standard of land preparation has again been noted, but difficulty has been experienced in preparing soils which have been late ploughed. Getting a good deep ploughing and a good tilth on these late ploughed lands, using unsuitable equipment, has retarded progress. There is a fairly widely held view among farmers that late ploughing is the only sure way of producing really good quality tobacco.

Layout of Lands: Much progress has been made in this aspect. Water planting and the use of reaping machines have forced many farmers to improve their standard of management in this direction, because without good land layout and organization these operations are difficult to accomplish efficiently.

Ridge alignment is a problem which is difficult to resolve satisfactorily, because for good organization and efficient water planting, reaping and supervision, the ridge at right-angles to the contour offers the best solution. However, this leads to greater erosion than the angled ridge or the ridge on the contour.

Fertilizer and Soil Ameliorants: High levels of phosphate and a tendency to higher potash applications are general. In many cases the use of both these constituents is at a higher level than would be normally recommended by the T.R.B. for the soil type. There is no doubt that in some cases applications of fertilizer are unnecessarily lavish and, while not entirely wasted as far as phosphate is concerned, the tobacco crop is probably not giving an economic return on these high applications—particularly in the very sandy soils.

With the information available regarding chlorine and its bad effects on tobacco grown on some soil types, the all-sulphate mixtures "A" and "B" have enjoyed a fairly wide popularity in the 1959-60 season. The danger exists that these mixures will be used on soil types which might benefit from the normal mixtures containing chlorine. Farmers have been inclined to assume that chlorine is the cause of all their troubles without going fully into the question. Such *ad hoc* conclusions can be dangerous.

The question of liming came sharply into prominence for the first time this past season. It has been shown that in many of our tobacco soils pH values have dropped and in some cases are below the range for optimum growth of tobacco. It is likely that, particularly in the case of rotated lands, farmers will have to undertake routine liming after each tobacco crop at the time of ploughing down stalks.

Planting: Planting out with water has become an established practice on the majority of farms. Some farmers plant their entire tobacco crops with water treated with insecticide irrespective of rain, but most farmers plant only the larger proportion of their crops in this way.

The crop fell into two categories—an early crop planted before the 15th November and the late crop planted after the 15th November, but concentrated in December. High yields were recorded from all areas from the first planting, which

constituted 60 per cent. of the overall crop. The last 40 per cent. gave a poor yield of poor quality tobacco in most cases.

Plant populations tended to be lower than previously and stands were universally good—a factor that contributed largely to the high yields.

There are definite indications from a fairly large number of farmers that they intend planting their entire crops early in future. Provided this takes into account barn space, labour and organization, only good can result.

Crop Progress: Good rains in October, followed by a dry November, resulted in severe sun-scorching, but recovery was spectacular when rain fell and the tobacco grew out normally. Topping was done on the high side and in many cases rather too late. Suckering on the whole was well done. The late crop suffered from the heavy rain in early January and never really recovered.

Reaping was generally satisfactory, many farmers leaving their tobacco on the stalk to get really ripe—a feature not usually seen in Rhodesia. Other farmers tended to reap green, and immature close-grained tobacco was the result together with depressed prices.

Reaping machines were used on an increased scale and it would seem that this method of reaping will, with the passage of time, supplant all older methods. The use of these machines has necessitated increasing the row width and the effects of this have, in general, been beneficial.

Barns, Curing, Bulking and Grading: The effective splitting of the crop enables farmers to handle with very little loss the tobacco from approximately 216,000 acres. Barns, however, were used to capacity and in effect, because the crop did not overlap, there were actually sufficient barns for only 130,000 acres. If more tobacco is to be planted early in future, more barns are a first essential. Considerable building of new barns, improvements to existing barns and the provision of better handling facilities took place during the year. In this sphere of construction and in that of tobacco curing, it is apparent that there is a need for more specific data on the relationship between furnaces, flues and chimney sizes and their effects on the efficiency of heat exchange.

The hygrometer for curing was used on an increased scale and particularly in North-western Rhodesia this instrument is almost universally employed. Generally, however, farmers do not appreciate how much an aid it is to curing. More intensive information on its significance is obviously necessary for the future.

Off-type tobacco, e.g. slate, slick and sponged tobacco, was again much in evidence. Some of this off-type tobacco was due to poor curing, but in many cases this condition appeared to be beyond the control of the farmer.

Bulking must be improved as regards method before any appreciable improvement can take place in grading. Bad bulking (of which there is far too much) results in bad grading and if our grading is to improve, this will take place only as and when farmers adopt a method of bulking which ensures that tobacco of the same type is kept together in one place. This is not the case on the majority of farms.

Diseases and Pests: Anthracnose was the most serious disease in seed-beds, while in the lands Rosette came in early on the late crop, infections being severe and crippling in many cases. A new virus disease, provisionally called Karoi Disease, was reported from Karoi, Ayrshire and Northern Rhodesia. It appears to be aphis-borne and may become serious for this reason. Other diseases, although present, were not serious, except for Frog-eye and Barn Spot in Fort Jameson, where infection assumed serious proportions towards the end of the reaping.

Rotations: Tobacco followed by two to five years of grass continues to be the most widely accepted rotation, although it is by no means general as yet. Love Grass *(Eragrostis curvula,* Ermelo strain) and Katambora Rhodes *(Chloris* spp.) continue to be most popular, although Love Grass is losing ground because of the difficulty of ploughing it late in the year.

Reverted, virgin and second year lands are still appreciably used.

Fumigation: Many farmers are finding it essential to fumigate in spite of using either Love Grass or Katambora Rhodes. Very good results are being obtained when the material is applied in dry soil.

Field Experiments: There were four fertilizer trials and one variety trial on flue-cured, run in collaboration with the Tobacco Research Board on farms in Southern Rhodesia, and two fertilizer trials on flue-cured and two trials on Turkish run on the Msekera and Mochipapa Experimental Farms in Northern Rhodesia. There were also an N.P.K. variety trial and date-of-planting trial on Burley at

Msekera and a variety trial and N.P.K. trial on Burley at Panmure near Shamva in Southern Rhodesia. Of these trials, three fertilizer trials in Southern Rhodesia had to be abandoned because of hail, disease and a poor stand respectively and the Turkish experiments in Northern Rhodesia had also to be abandoned. The remainder were brought to finality and were evaluated by the Tobacco Research Board of Rhodesia and Nyasaland. Special appreciation is expressed to those farmers who co-operated in carrying out these trials and the Tobacco Research Board for designing the trials and analysing the results.

General Remarks on Virginia Tobacco: (1) The accumulated experience of eight years, since the Tobacco Research Board was constituted in its present form, has enabled farmers to grow and handle a record crop of approximately 191 million pounds. It can confidently be expected that, irrespective of the type of season experienced in the future, the quantity of tobacco required by our markets will be available. Quality must be raised, but there is little doubt that in this important aspect our farmers will also succeed. Early planting, good seedlings and seedbed management, good stands, good land preparation and sound organization will accomplish for quality what has been done as far as yield is concerned.

(2) For tobacco growing to pay, farmers must plant out with water.

(3) Farm planning is one of the major aids in raising standards of production as far as quantity and quality are concerned.

(4) Irrigation as such is hardly a factor in our production at the present time.

(5) A member of the Department was seconded on a full-time basis to Frasers and Associates to assist in the pilot scheme for studying time and motion in tobacco. The scheme is continuing with three additional officers, plus the original officer, participating in this work during the 1959-60 season.

Fullest praise should go to our growers for establishing so many records in the flue-cured crop. This was achieved by applying the best that research could offer in the way of better techniques, better management and organization and hard work. The contribution made by the Department of Conservation and Extension is generally accepted as a not insignificant one.

Fire-cured Tobacco: Only five growers grew fire-cured tobacco this past season, the acreage being 144 and the total weight an estimated 90,000 lb. After the collapse of the sales, sale by auction was discontinued and it is not thought that this crop will feature seriously in this country's agriculture in the future.

Turkish Tobacco: With the formation of the Central African Turkish Tobacco Growers' Association, it is likely that some sort of centralized control and guidance of the Turkish Industry will be possible.

As usual much interest was engendered early in the season, but this interest tended to wane as the summer progressed. The Turkish crop was virtually all planted by the end of March, but the early cessation of the rains affected the crop most adversely. It is interesting to note that two growers grew approximately 60 acres each of Samsun and Soulook respectively.

If Rosette can be overcome, Turkish might well displace the late flue-cured crop.

Burley Tobacco: The main area outside of Nyasaland for growing Burley is Fort Jameson, where 12 growers grew approximately 1,000 acres of this type of tobacco, selling 576,822 lb. of leaf at an average price of 23.58 pence per pound. Although the so-called coloury grades are asked for by the buyers, growers find that the prices paid for the darks, which are easier to handle, do not justify the production of the lighter tobacco.

In the south-west area, eleven growers grew Burley on approximately 36 acres, producing approximately 27,000 lb. of leaf. This crop was processed by the Turkish Co-operative Society Ltd. at Darwendale, who are negotiating to sell the crop. It is unlikely, unless the present crop can be sold to advantage, that Burley will be grown again in this area.

Cotton: There has been a marked increase in production of this crop in the Midlands Region, due entirely to the efforts of the Sabi-Tanganda Estate which reaped 2,000 lb. per acre of first-grade cotton from 500 acres of irrigated land. This excellent achievement demonstrates what can be done by assiduous attention to detail—particularly in the control of insect pests by spraying. Farmers in the Umshandige Valley are showing an intest in this crop in consequence of the results obtained in the Sabi area.

Little cotton was grown elsewhere in Southern Rhodesia during the year.

Castor Bean: Due to poor yields and the depredations by disease and insect pests the interest in this crop is extremely small. The limited plantings in the Mazoe Valley and in the Macheke area gave indifferent yields.

Kenaf: Considerable trial acreages of this crop were grown in the Mazoe, Salisbury and East Hunyani Groups and, to a lesser extent, in the Umfuli Group during the year, the yields varying from fair to good. In the Eastern Districts the main effort was directed towards solving certain of the mechanical problems involved in the growing and handling of kenaf. Great strides were made in this direction, but the Government's decision to close the fibre factory at Umtali brought these activities to an end.

There is no doubt that good yields of high quality fibre can be obtained from kenaf which, with proper treatment, grows well in the heavier soils in the higher rainfall areas of Rhodesia. An effort is being made to maintain interest in this crop and to develop it for the export market.

Grass and Vegetable Seeds: There is a steadily developing interest in this line of production in the Midlands and Mashonaland, but much remains to be learnt about the techniques of growing economic quantities of high quality vegetable seed for commercial use. It is a field of production in which prospects appear very promising.

Tea: The three companies which have established themselves in the Eastern Districts have all expanded their acreages considerably and within a few years there should be approximately 6,000 acres under this crop in that area.

Coffee: Great interest in the potential of this plantation crop is being shown in the Chipinga area, where trial plantings of fair size are being and have been made. It is anticipated that some 250 acres will have been established to coffee by the end of the present season.

Sugar: Sugar production is increasing with great rapidity in the Victoria low-veld, where almost 4,000 acres of new cane have been planted during the last 12 months—a large proportion of which is under spray irrigation. Besides the Triangle Estates, which are currently the largest producer, there are three large organizations, two in that part of the Victoria Group and one in the Zambezi Valley, which are planning to grow substantial acreages of this crop. There is no doubt that before long the Federation will produce all its requirements of sugar.

Softwoods: There is an increasing interest in the establishment of suitable species for farm use in Mashonaland and in the Charter area of the Midlands. On the Eastern border the softwood industry, although currently almost entirely the preserve of the State and large scale commercial enterprise, might well be entered into by the ordinary farmer. There is a great deal of Class VII land which could profitably be employed for this purpose on private farms.

Wattle: With the slight decline that has taken place in the price of wattle extract, there has been no further expansion of the acreage established to this species. The general position of the wattle industry is satisfactory.

(iii) *Fodder Crops.* In the Midlands, due to the publicity that has been given to urea/molasses as a supplementary source of protein, there has been a slight falling off of interest in fodder production but despite this fact over 3,000 acres of Napier Fodder have been established during this season.

Farmers are definitely more conscious of the importance of making silage and good quality hay than they were a few years ago and are showing much interest in foggage provision and the establishment of dhal as a browse for animals in frost-free areas.

There has been a steady increase in the production of lucerne under irrigation in the drier areas and in the better-watered parts grass/clover pastures are being used to very good effect by stock owners. Oats as a winter feed is a popular crop and was grown fairly widely under irrigation during this last dry season to provide green feed so important to stock at this time of the year.

Although fairly satisfactory, the overall position is not as good as it should be. There is room for great expansion in the acreage of fodder crops that can and should be grown to help tide livestock over the critical winter months when succulent green material is in such short supply.

(c) *Livestock*

The season was not a good one for livestock in the Midlands due to the early cessation of the rains and in Matabeleland it is regarded as being the most difficult one that has been experienced there since the drought years of 1946 and 1947.

(i) *Cattle—Beef Cattle:* Greater interest than ever before was shown by farmers in this industry, with its very sound long-term prospects, and there is no doubt that it is on the verge of considerable expansion.

There has been a marked improvement in all aspects of beef production, brought about, it can be said without hesitation, by the many high level cattle courses which have been held in collaboration with the Department of Research and Specialist Services, by field-days and numerous extension visits to farms that have been made by officers of this Department. The standard of bulls used continues to rise and the standard of management to improve in the drier areas where farmers have that essential background experience so necessary for successful stockmanship. Even in the higher rainfall tobacco growing areas there is a noticeable improvement in the standard of management in many Groups, but the room for improvement in this sphere is still very great.

The feeding of winter supplements is on the increase. At the present time a urea/molasses mixture fed in conjunction with veld hay or corn cob-meal is extremely popular and is giving good results when it is properly used to maintain the weight of animals during the winter months. Thirty per cent. protein cubes containing urea are being used on a fairly large scale in certain areas; in the Midlands these cubes have helped maintain weaners, being spread on to mown veld behind the moving tractor.

Dairy Cattle: Progress made by dairy producers during the last year in raising their standards of efficiency has been gratifying, but there is no doubt that there is still room for a great deal of improvement in this respect—particularly as regards feeding and management and the production of home-grown feed to help keep costs to a minimum. Reduced prices for milk, together with increased costs of production, have shown up many weaknesses among dairymen in Matabeleland and elsewhere, some of whom are on extremely marginal levels of production.

(ii) *Sheep:* There is a slow but steady increase in not only the size but also in the numbers contained in individual flocks of hardy mutton sheep such as the Blackhead Persian and the Dorper or Wiltiper/Blackhead Persian crosses that are run on many farms in Southern Rhodesia. This is particularly true of the Midlands where there are now two flocks each containing over 1,000 head.

The Sheepbreeders' Association, formed in 1958, has done much to stimulate interest in, and sound development of, mutton sheep as a supplementary source of income on farms.

(iii) *Goats:* Unfortunately, very little interest in goats exists in the country, although farmers sometimes run small numbers as a source of meat for their labour.

(iv) *Pigs:* The position remained unchanged during the year, the overall number of producers remaining approximately the same as during 1957/58.

Standards of breeding, feeding and management showed further improvement.

Local breeders do not seem to be having any difficulty in meeting the demand for breeding stock.

(v) *Poultry:* The position has remained static, no increase in the numbers or size of individual flocks having occurred except in Matabeleland. Demand for poultry products appears to be satisfied by the large, efficiently run and well established poultry producers.

(vi) *Fish:* Interest in freshwater fish as a source of protein is being maintained, but there has been no noteworthy increase in the number of farmers who have gone in for this form of production.

Fish production as a source of cheap protein for labour can very profitably be pursued by farmers in conjunction with dairying and pig-keeping—the urine and washing-down water from the cow byres and pens being led into the ponds to fertilize the plankton and weed growth on which the fish subsist.

(vii) *Livestock Improvement Scheme:* This Department continued to administer the scheme, all inspections being carried out by Extension Officers and the Secretary of the Committee. During the year four meetings of the Committee were held, the number of applications dealt with being 257—two more than during the previous twelve months. The number of animals involved in these applications were 294 bulls and 70 cows and heifers respectively, as well as 18 rams and 17 boars.

During the period covered by this report, the L.I.S. Committee recommended that the rules and regulations governing the operation of the scheme in Southern Rhodesia should be amended slightly to bring it more into line with a somewhat similar scheme that operates in Northern Rhodesia.

There was a marked drop in requests to purchase bulls at the Easter and September sales in the Union of South Africa. One member of the Committee

attended the Rand Easter Show Sale, where he purchased three bulls for farmers; in contrast to last year when the Committee was not represented at the September sales in either Johannesburg or Bloemfontein.

Details of stock purchased by the Committee for farmers during the year are given below:

		£	s.	d.
Pedigree bulls	4 for	744	15	0
Pedigree females	6 for	875	0	0
Grade females	67 for	3,777	0	0
TOTAL	77 for	£5,396	15	0

Of the above, one bull, an Aberdeen Angus, was purchased locally for one of the Research Stations, the rest being bought in the Union of South Africa.

Importation of Cattle from the Union of South Africa: The following male and female stock were imported either by the Livestock Improvement Committee or by the farmers themselves:

	1.10.58 to 30.9.59	1.10.57 to 30.9.58	1.10.56 to 30.9.57
Pedigree Bulls			
Ayrshire	2	—	—
Friesland	21	30	39
Guernsey	2	3	—
Jersey	16	17	9
Aberdeen Angus	1	1	2
Africander	102	196	125
Hereford	9	20	8
Shorthorn	1	3	1
Sussex	6	26	47
South Devon	2	5	2
Red Poll	5	5	1
Brown Swiss	1	7	2
Brahman	—	4	—
Dexter	1	—	—
Siementhaler	1	—	—
North Devon	1	—	—
TOTALS	171	317	236
Pedigree Females			
Ayrshire	—	—	4
Friesland	47	29 plus 1 calf	44 plus 1 calf
Guernsey	9	16	—
Jersey	58 plus 4 calves	36 plus 4 calves	16
Africander	69 plus 14 calves	48 plus 6 calves	47 plus 8 calves
Sussex	—	16	—
Brown Swiss	—	12	3
North Devon	—	—	17 plus 1 calf
Red Poll	6 plus 1 calf	—	5
Hereford	—	40 plus 7 calves	—
Dexter	4 plus 3 calves	—	—
Siementhaler	3 plus 1 calf	—	—
TOTALS	196 plus 23 calves	197 plus 18 calves	166 plus 10 calves
Grade Females			
Ayrshire	—	20	6
Friesland	465 plus 17 calves	314 plus 1 calf	219
Jersey	232 plus 6 calves	225 plus 15 calves	157 plus 9 calves
Guernsey	—	8 plus 2 calves	9
Shorthorn	—	—	9
South Devon	—	—	16
Sussex	—	—	10
Dexter	7 plus 3 calves	—	—
Brown Swiss	12 plus 1 calf	—	—
TOTALS	716 plus 27 calves	567 plus 18 calves	426 plus 9 calves

Stock imported from the Union of South Africa under special permits issued by the Union Authorities:

	1.10.58 to 30.9.59	1.10.57 to 30.9.58	1.10.56 to 30.9.57
Pedigree Bulls			
Aberdeen Angus	—	1	—
Africander	—	5	10
TOTALS	—	6	10

	1.10.58 to 30.9.59	1.10.57 to 30.9.58	1.10.56 to 30.9.57
Grade Bulls			
Friesland	—	—	1
Africander	—	4	10
Shorthorn x Africander	—	—	20
Brahman x Africander	—	—	2
TOTALS	—	4	33
Pedigree Females			
Aberdeen Angus	—	10	—
Africander	50	10	25 plus 20 calves
TOTALS	50	20	25 plus 20 calves
Grade Females			
Friesland	10	—	10
Jersey	—	—	26 plus 9 calves
South Devon	—	—	10
Sussex	—	—	10
Africander (Red)	25	90 plus 85 calves	—
Africander (Yellow)	20	—	—
TOTALS	55	90 plus 85 calves	56 plus 9 calves

Imported from Bechuanaland	
Africander Pedigree	12 bulls and 2 cows
Africander Yellow	2 bulls and 6 cows
TOTALS	14 bulls and 8 cows

Importations of cattle from the United Kingdom during the year were as follows:

	1.10.58 to 30.9.59		1.10.57 to 30.9.58		1.10.56 to 30.9.57	
	Bulls	Heifers	Bulls	Heifers	Bulls	Heifers
Ayrshire	2	2	—	—	—	12
Friesland	—	—	1	—	—	1
Jersey	2	3	3	9	2	2
Aberdeen Angus	2	1	1	—	—	—
Hereford	1	—	2	—	—	—
Shorthorn	2	1	—	2	—	5
North Devon	—	—	1	—	—	—
Sussex	2	—	—	—	—	—
TOTALS	11	7	8	11	2	20

No cattle were imported from the United States during the year.

Importations of pigs during the year are given below:

	United Kingdom		Union of South Africa	
	Boars	Gilts	Boars	Gilts
Landrace	2	2	1	—
Large White	1	—	1	2
Wessex	1	1	—	—
TOTALS	4	3	2	2

Visits were made during the year by Breed Inspectors of the Africander, Friesland and Jersey Breed Societies. These Inspectors were accompanied by Extension Officers on their visits to the various breeders. Inspection for registration of several breeds was also carried out by the Secretary of the Livestock Improvement Committee.

It is of interest to record that six pedigree Africander bulls and 120 high-grade females were exported to Israel. This importation by the Israeli Government is in the nature of an experiment to see how these animals will do in the hot and dry parts of that country.

6. PRODUCTION FROM IRRIGATION

(a) *General Progress of Irrigation*

Excluding sugar-cane, crops under irrigation in Southern Rhodesia have increased by almost ten per cent. on an area basis during the last year. This was brought about largely by the establishment of increased acreages of citrus, potatoes, lucerne and vegetables for seed production. In contrast, the area under summer supplementary irrigated tobacco, and possibly wheat, has decreased and there has been no increase in the acreage planted to supplementary irrigated maize. The acreage under sugar-cane in the Triangle area of the Victoria lowveld and the Zambezi Valley is expanding.

Due to greater interest in the supplementary feeding of cattle, a marked increase in the acreage of irrigated lucerne can be expected; better fertilizing and improved cultural operations are resulting in the achievement of increased yields which are making the growing of this valuable fodder crop more attractive than it used to be.

Cotton is becoming a very profitable summer crop under supplementary irrigation in the Sabi Valley and could prove as successful elsewhere in the drier and warmer parts of the country.

Estimates of the acreage under irrigation this year are as follows:

Eastern Region	11,000 acres
Mashonaland	10,000 acres
Midlands	8,000 acres
Matabeleland	5,000 acres
	34,000 acres
Under Sugar-cane	7,000 acres
Making a Grand Total of	41,000 acres

(b) *Irrigation Officers*

During the past year the post of Irrigation Officer for the Midlands and Matabeleland Regions was vacant—a fact that has retarded irrigation development considerably in these areas. There is no doubt that officers specializing in irrigation do a tremendous amount of good in assisting farmers develop efficient and economic schemes.

(c) *Training Courses*

One intensive two-weeks course was held for officers of the Department, and officials from the Department of Research and Specialist Services and the University College of Rhodesia and Nyasaland also attended. Three short courses of two days' duration each were held for farmers in Umtali, Bulawayo and Henderson Research Station.

In all, 160 farmers and officials attended these various courses.

(d) *Major Schemes*

(i) *Umshandige:* The main irrigation crops are still wheat and barley—yields of which were reasonable this season. Summer supplementary irrigated maize was not very well done and the yields were poor; this neglect was occasioned by the inordinate amount of time it was necessary to spend on irrigated tobacco. The latter crop, unfortunately, did not do well and has a limited future in this scheme.

Overhead irrigation continues to be popular and the use of this method of applying water is increasing.

(ii) *Umgusa:* The main activity continues to be dairying and the production of fodder crops of which lucerne is by far the most important.

(iii) *Coloured Settlers' Scheme—Mazoe:* The two better settlers continue to make good progress and one other is managing with difficulty to make a living. The future of the other two who are not doing well is not at all secure.

(iv) *Que Que Irrigation Development:* Resulting from negotiations between the Southern Rhodesian Government and the Que Que and District Irrigation Committee, sufficient water from the Ngesi Dam to irrigate 800 acres was made available to farmers along the banks of the river. The charge is £1 per acre-foot of water. About half of this water has been taken up by farmers, nearly all of whom are interested in growing lucerne for stock feed.

(v) *Triangle Sugar Estate:* The 4,000 acres under overhead irrigation have been planted to sugar-cane and work is now in progress clearing land for irrigating from Kyle Dam. No figures are available of the average yield of cane on Triangle Estate, but it appears that the overhead system is not giving greatly increased yields as yet.

The cane on the settlers' farms is growing well, but there is still room for improvements in water application.

(vi) *Hippo Valley Citrus Estate:* The young citrus trees on this estate are growing very well. A 100-acre block of fine alluvial sand is being cleared and prepared for the growing of sugar cane under overhead irrigation.

Clearing of land for irrigation from the Kyle Dam is progressing.

(vii) *Chirundu Sugar Estate:* Two visits were made by the Senior Irrigation Officer to the above-mentioned estate during the year. It was most pleasing to see the enthusiasm and determination with which this vast project was being tackled.

A variety trial, as well as trials on the frequency of irrigation and the effect of trash on sugar-cane, are in progress.

(viii) *Sabi Development Farm:* The new lessee, Mr. Hein, has completed his first year on the farm and has settled down very well. The farm continues to fulfil its main function of providing information about farm-scale irrigation in the Sabi Valley.

The first plantings of lucerne were completed as per the recommended rotation which, with the passage of time, will embrace more and more lands. Maize yielded no better than the previous year, rodents having caused much damage to the planted seed. Cotton gave good yields, but difficulty was experienced in germination due to severe crusting of the soil; to overcome this problem an overhead sprinkler unit was purchased by the lessee, which should prove satisfactory. A very small acreage of a selected wheat variety which was planted yielded well despite some bird damage.

7. SOIL CONSERVATION

(a) *Arable Areas*

(i) *General:* The mechanical protection of arable lands from soil erosion is now an accepted principle and in very few cases during the year was it necessary for I.C.A. Committees to recommend the use of Section 26 of the Natural Resources Act to persuade farmers to co-operate in this regard.

Farm planning has had a beneficial effect in focussing attention on the importance of wise land use. The end results of this approach will manifest themselves more markedly and profoundly as more farms are planned and lands are brought into production that are best suited for arable use.

Due attention has been paid to the drainage of arable lands that normally would be too wet in which to grow crops satisfactorily. The ridge and furrow method of surface drainage is being used by a steadily increasing number of farmers, especially in the Midlands Region, and subsurface tile drains are being laid in many wet lands on tobacco farms in the Norton area.

(ii) *Mechanical Protection of Arable Land:* The table below indicates what has been achieved in this direction.

Region	Period	Contour Ridges & Storm Drains (Miles)	Bench Terraces (Miles)	Irrigation Furrows (Miles)	Pasture Furrows & Veld Ripping (Miles)
Mashonaland	1956/57	3,327	2	21	—
	1957/58	3,137	1	41	7
	1958/59	3,356	—	24	—
Midlands	1956/57	703	13	36	24
	1957/58	760	2	22	5
	1958/59	754	6	40	62
Matabeleland	1956/57	158	1	11	—
	1957/58	395	9	21	—
	1958/59	350	2	13	1
Eastern	1956/57	1,558	10	56	2
	1957/58	1,818	9	54	—
	1958/59	1,664	5	35	3
TOTALS	1956/57	5,746	26	124	26
	1957/58	6,110	21	138	12
	1958/59	6,124	13	112	66

(b) *African Cultivation*

The position continued to improve, largely through the efforts of various Intensive Conservation Area Committees and the general guidance and help made available by the staff of this Department. In Matabeleland and in the Eastern Region the response of Mission stations to requests from I.C.A. Committtees to bring about improved land use has been outstandingly good and they are slowly but surely implementing their farm plans in which sound use of the land by Africans constitutes an important part.

Large estates in the Midlands have co-operated admirably in this matter and it seems that at last some real progress has been made in controlling the squatter labour that hitherto has been allowed to cultivate indiscriminately in rather ill-demarcated blocks.

(c) *Roads and Railways*

An extremely close and cordial relationship exists between the Roads Department, Road Councils and the staff of this Department who are regularly called upon to advise on matters concerning alignment and drainage and erosion control measures.

There is great room for improvement in the standard of farm roads, the alignment of which is frequently incorrect and the drainage in many cases non-existent. The implementation of farm plans should help effect a real improvement in this situation.

Problems of mutual concern to the Railway authorities and to this Department are dealt with as and when they arise.

(d) *Research*

(i) *Erosion Control:* Overall progress in this field was reduced by the absence, on a study tour of the U.S.A., of the Senior Research Engineer and by his acting on his return as Chief Conservation Engineer when the latter Officer himself was overseas on a similar visit.

The tempo of this work will increase to its normal level with the return of the Senior Research Engineer to his normal duties in December, 1959.

Report on Present Programme of Erosion Control Research

(1) No new experiments, not previously reported, were instituted during the 1958-59 season.

(2) The miniature run-off plots installed in 1958 went through their first season, but results were inconclusive and the project will be continued for another year at least.

(3) The study of the drop-size distribution and mechanics of erosion under intense tropical rainfall has produced the interesting if negative result that tropical rainfall does not follow the pattern of those types of rainfall previously investigated, and that drop size is not a function of intensity. Hence it is improbable that erosivity can be determined from, or recorded by, any meteorological instruments at present available. The ultimate object of this exercise is the development of a rainfall simulator which will be invaluable in the solution of practical erosion problems, but this cannot proceed until a solution is found to the problem of why one storm causes more erosion than an apparently similar storm. The rainfall study will be continued with improved instrumentation and it is hoped to complete it during the 1959-60 season.

(4) Studies of fertility losses continued but it has not been possible to complete the laboratory analyses or calculate results. The study continues and after the 1959-60 season the results of three years' investigation will be analysed simultaneously.

(5) The "Joint Evapotranspiration Project", operated in collaboration with the Federal Department of Research and Specialist Services, the Federal Department of Meteorological Services and the University College of Rhodesia and Nyasaland, continued for a full season in 1958-59 after its calibration run in 1957-58. All the collaborating agencies suffered staff difficulties and the compilation of results is disappointing. The experiment will, however, continue.

(6) Field scale experiments continue comparing trash farming and stubble mulching. Four years' results have confirmed on a field scale the observations originally made on small plots, that when combined with adequate plant population and correct fertilizer applications, both stubble mulching and trash farming are effective in virtually eliminating both run-off and erosion. It is also apparent that yields are appreciably reduced by true stubble mulching techniques (i.e. with no ploughing) and that trash farming can successfully be applied without any special equipment or machinery.

(7) The main experiments on run-off and soil loss continued, and while here, too, there is a backlog of analyses, the main results were calculated and included in a publication covering the whole of the last six years' work.

(ii) *Drainage Research:* Most of the 1958-59 rainy season was spent on a study and assessment of the drainage problems of the country. An exploratory trial with tile drains was put down at Grasslands Research Station.

During the winter of 1959 a start was made on a full experimental programme which will commence in earnest during the 1959-60 rainy season. The main projects are:

(1) A preliminary study of tile drainage on all major soil types of the country.

(2) A detailed study of several existing tile drainage schemes in the Norton area.

(3) A quantitative study of the effect on surface run-off of the ridge and furrow layout used in the Gatooma area.

(iii) *Catchment Studies:* In co-operation with the Hydrological Branch of the Department of Irrigation, work was started on studies of the behaviour of surface run-off from small agricultural catchments. Recording flumes have been constructed for installation before the 1959-60 season on six small sub-catchments of from 20-60 acres within a 500-acre catchment in the upper part of the Sabi River Catchment. The information so obtained will form a valuable link between the river gaugings of the Hydrological Branch and the small plot measurements of this Department.

(iv) *Run-off Plots:* A standardized design for small-scale run-off plots has been developed so that uniformity will allow the comparison of results from many areas. Plots of this nature are being built at Chalimbana Experimental Farm in Northern Rhodesia and the Odzi I.C.A. in the catchment of the Condo dam. A similar, but simpler design is available for use of schools where the accent is on demonstration rather than experimental accuracy.

(v) *Gully Control Experiments on Mopani Soils:* Experiments have been continued and extended near Que Que on possible measures for the serious gully erosion that exists in many parts of the country on mopani soils. Many types of earth and brick structures will be tested, both alone and in combination with vegetation. A large number of experiments have all been concentrated in one large gully so that it will serve as a demonstration centre. The first results will be obtained after the 1959-60 rainy season, but the project will continue for several years.

These experiments on control measures are associated with the existing trials of chemical amendments such as gypsum, sulphur and other fertilizers to help establish vegetation on these difficult soils.

(e) *Grazing Areas*

(i) *General Management:* The overall picture is an encouraging one, except in parts of Mashonaland where the general standard of management is rather low due to insufficient watering points and inadequate fencing. Farmers are becoming more and more aware of the importance of these two requirements in consequence of the farm planning campaign that is at present in progress.

The condition of the grazing at the end of the current winter was reasonable in most parts of the country, except in some of the medium and low rainfall areas where rains stopped early and overstocking took place.

(ii) *Veld Fires:* This last dry season has been one of the most favourable in living memory for uncontrolled veld fires that have ravaged thousands of acres in the Eastern Districts, Mashonaland and the Midlands. In the Victoria lowveld ranchers had a particularly difficult time endeavouring to cope with fires that on one occasion stretched in one unbroken line across many miles of bush. The strong winds of August and September helped the tinder-dry vegetation to burn more fiercely than usual on a vast scale.

In Matabeleland, in contrast, comparatively few fires were reported.

(iii) *Bush Encroachment:* This continues to be an extremely difficult problem in Matabeleland and parts of the Eastern Midlands Regions. No completely effective means of eradication other than by expensive mechanical methods—including laborious hand stumping—have yet been devised for those areas where the bush is now so thick that the resulting grass cover cannot support a fierce controlling burn. This is a matter that requires the urgent attention of research workers.

(iv) *Fencing:* The implementation of farm plans has, in nearly all areas, led to the establishment of more paddock fencing—an encouraging development which will rebound to the benefit of stockowners.

Costs are still high, unfortunately, being in the vicinity of £100 per mile for a four-strand barbed wire fence erected to Government specifications.

8. WATER CONSERVATION

(a) *Dams Built Under the Guidance of the Department*

The most striking feature of the past year has been the great increase in the number of stock-watering dams that have been constructed in Matabeleland, a development brought about not only by the realization that the sequence of good rainy seasons cannot last indefinitely, but also by the impetus that farm planning has given to water conservation. In other areas the progress in this sphere has not been as impressive and in the case of Mashonaland there has actually been a retrogression. During the coming year a special effort will be made to stimulate interest in essential water conservation in the Eastern, Mashonaland and Midlands Regions.

In the table below the position in regard to dam construction during the year ended the 30th September, 1959, can be seen at a glance:

Region	Period	No. of Dams	Aggregate Capacity Gallons	Average Capacity per Dam, Gallons
Mashonaland	1956/57	72	399,020,000	5,542,000
	1957/58	105	473,928,000	4,513,000
	1958/59	85	605,000,000	7,000,000
Midlands	1956/57	77	781,850,000	10,284,000
	1957/58	84	253,360,000	3,016,000
	1958/59	83	552,590,000	6,657,000
Matabeleland	1956/57	142	679,200,000	4,783,000
	1957/58	133	882,000,000	6,631,000
	1958/59	208	1,435,630,000	6,902,000
Eastern	1956/57	20	100,565,000	5,028,000
	1957/58	39	23,600,000	605,000
	1958/59	37	103,000,000	3,000,000
TOTALS	1956/57	311	1,960,635,000	6,304,000
	1957/58	361	1,632,888,000	4,520,000
	1958/59	413	2,696,220,000	5,890,000

The following table reveals that farmers are building a very substantial number of dams themselves and that units operated by this Department and by the Department of Irrigation are still being kept extremely busy:

Year	Farmers		I.C.A. Committee Units		Government Units		Total
	No.	%	No.	%	No.	%	No.
1956/57	146	46·9	50	16·1	115	37·0	311
1957/58	253	70·1	42	11·6	66	18·3	361
1958/59	286	69·2	32	7·8	95	23·0	413

(b) *Mechanical Units*

(i) *I.C.A. Units:* Four I.C.A. Committees owned and operated tractor units efficiently and economically during the year in competition with other concerns. Credit is due to the Committees and their staff for outstandingly good work in this field.

(ii) *Government Units:* There has been an increase in demand for work to be performed by the Department's Government units, which has most likely arisen because of the recent change over to a heavier and more powerful tractor capable of working more efficiently and thus more economically. A 26 per cent. increase in productive hours has been achieved and serviceability has been increased.

In addition to normal conservation work for farmers, these heavy units carried out a considerable amount of bush clearing for the Department of Tsetse and Trypanosomiasis Control in the Victoria lowveld during the year.

(c) *Catchment Schemes*

(i) *Bembesi-Inkwekwesi:* Chemical trials were undertaken on the highly erodible alkaline soils in this catchment, the grass cover of which was improved by heavy applications of gypsum and sulphur. The rates proved uneconomical for large-scale treatment, but are not too expensive for treating small local areas, such as water disposal points.

(ii) *Umzingwane:* All the work in this catchment, with the exception of one project on the farm, Happy Valley, has been completed.

(iii) *Kyle:* A small amount of finishing work was done in this catchment during the year; further projects in the planned programme of conservation work will be completed in 1959-60.

(iv) *Sebakwe:* Experimental work on gully control in mopani soil continued in this catchment during 1958-59.

(v) *Odzani:* From the land use aspect, work on this catchment plan is proceeding as rapidly as possible with the staff available. It is taking the form of giving priority to the complete planning of each farm within the catchment until the whole is completed.

(vi) *Tanganda:* Careful investigation of the flow in the tributaries of the Tanganda River has revealed that there is evidence of a decline in minimum flow and that the greater portion of the water in this river system flows from the south-eastern aspect of the Melsetter Highlands.

Remedies that have been suggested to improve water flow include small water storage schemes, bush eradication, improved veld management and a study of the effect on minimum flow of forestry projects, particularly wattle production.

(vii) *Sabi:* Work by the Sabi Planning Team continued at a rapid tempo in various minor catchments of the Sabi in the I.C.A.s of Wenimbi, Wedza, West Marandellas and South Marandellas.

9. FIELD TRIALS

The recently developed policy of having a central inter-departmental committee approve well in advance all field trials and demonstrations undertaken by officers of this Department has helped a great deal to co-ordinate field experimentation generally and smooth out certain difficulties that were wont to arise in the past due to misunderstandings concerning the manner in which the field work was to be conducted.

Trials during the 1958-59 season were, on the whole, well conducted and yielded much information of value. Some of them (for example the maize variety and the cotton variety trials) were done at the specific request of the Department of Research and Specialist Services.

The following table reflects the trials and demonstrations that were done in the individual Regions during 1958-59.

Type	Matabele-land	Mashona-land	Eastern	Midlands	Total
1. Trash farming trial	—	1	1	2	4
2. Drainage trial	—	—	—	1	1
3. Drainage demonstration	—	1	—	1	1
4. Velvet bean demonstration	—	—	—	1	1
5. Soya bean variety trial	—	1	1	1	3
6. Maize variety trial	1	3	2	3	9
7. Cotton variety trial	2	—	1	3	6
8. Castor variety/fertiliser trial	5	—	—	4	9
9. Kenaf demonstration	—	6	1	1	8
10. Jack bean demonstration	—	—	—	1	1
11. Stock feeding trials	1	—	—	1	2

Type	Matabele-land	Mashona-land	Eastern	Midlands	Total
12. Pasture demonstration	—	—	2	8	10
13. Dhal demonstration	—	—	—	2	2
14. Sheep breeding trials	—	—	—	1	1
15. Fodder crop demonstrations	—	—	—	1	1
16. Fertiliser trials on general crops	3	4	5	3	15
17. Winter wheat variety trials	—	—	3	1	4
18. Summer wheat variety trials	3	4	—	1	8
19. Bush control trials	—	—	—	6	6
20. Gully control trials	2	—	—	5	7
21. Fish farming demonstration	—	—	—	1	1
22. Trace element trials	1	1	—	—	2
23. Mopani soil experiments	1	—	—	—	1
24. Maize demonstration	1	—	—	—	1
25. Wheat on moisture-retaining soils	—	2	—	—	2
26. Sugar-cane demonstration	—	1	—	—	1
27. Fodder crop trials	—	—	2	—	2
28. Tobacco fertiliser demonstration	—	—	2	—	2
29. Banana fertiliser trials	—	—	2	—	2
30. Haricot bean demonstration	—	—	1	—	1
31. Groundnut variety trial	—	—	1	—	1
TOTALS	20	25	22	48	115

10. ADVISORY SERVICES

(a) *General*

Despite mileage restrictions, the officers of this Department maintained an extremely high output of work, as is revealed by the table below. The advice and guidance that they gave to farmers on a great variety of subjects, through ordinary extension visits and the medium of farm planning, played no small part in helping those on the land achieve the high yields of maize and tobacco that were harvested this year. In the sphere of animal husbandry, too, officers have contributed a great deal to the industry in assisting stockowners achieve a higher standard of efficiency.

VISITS MADE BY OFFICERS OF THE DEPARTMENT

	Eastern	Midlands	Matabele-land	Mashona-land	Total
Pegging					
1. Contours	740	436	117	1,798	3,091
2. Storm drains	14	33	31	66	144
3. Grass strips	7	19	4	73	103
4. Other (pasture furrows)	5	58	12	239	314
5. Roads and road drains	38	109	29	263	439
6. Irrigation works	76	98	60	82	316
7. Dams	150	333	420	537	1,440
TOTAL	1,030	1,086	673	3,058	5,847
Inspections					
1. Subsidy	21	44	120	81	266
2. Water Court	91	81	31	235	438
3. Roads	45	69	34	117	265
4. Timber cutting	3	5	4	9	21
5. Land settlement and Crown land	9	67	30	69	175
6. Subdividion of land	42	32	24	103	201
7. Seed	14	8	6	22	50
8. Livestock improvements	45	110	94	147	396
9. Livestock—other	66	50	30	59	205
10. Mechanical units	151	174	462	975	1,462
11. Miscellaneous	193	292	209	485	1,179
TOTAL	680	932	1,044	2,002	4,658
Advisory					
1. Field crops	1,603	1,242	222	1,544	4,611
2. Veld and pasture	45	141	61	58	305
3. Livestock	45	189	277	99	610
4. Irrigation	65	180	101	78	424
5. Conservation	196	742	372	841	2,151
6. Farm planning	626	1,711	745	477	3,559
TOTAL	2,580	4,205	1,778	3,097	11,660
Meetings					
1. I.C.A. and Group	229	376	290	508	1,403
2. Farmers' Association	57	83	61	117	318
3. Staff	99	119	100	325	643
4. Miscellaneous	205	184	109	320	818
TOTAL	590	762	560	1,270	3,182

	Eastern	Midlands	Matabele-land	Mashona-land	Total
Other Visits					
1. Research stations	83	84	64	147	378
2. Farmers' days	159	253	71	343	826
3. With committees	309	79	36	175	599
4. With specialists	211	266	239	432	1,148
5. Miscellaneous	570	353	363	1,378	2,664
6. Field trials	162	441	258	325	1,186
TOTAL	1,494	1,476	1,031	2,800	6,801
GRAND TOTAL	6,374	8,461	5,086	12,227	32,148

(b) *Tobacco Advisory Work*

The work carried out by officers trained to advise on tobacco is given in the analysis of visits shown below.

	1958/59	1957/58
Farm visits	5,905	5,203
Visits to T.R.B. Stations	376	312
Grading shed inspections	197	175
Miscellaneous	732	447
	7,210	6,137
Discussion groups	432	N/A
Attendance	7,496	N/A

Of the 5,905 farm visits, 3,355 (57 per cent. of all farm visits) were in answer to specific requests from farmers. This shows a 10 per cent. increase over last season and is a measure of the increasing importance placed by farmers on the service offered. It also indicates that field officers are using their time to better advantage as far as the farmer is concerned.

There are at present 38 field officers trained in tobacco plus a further three officers at Salisbury and Lusaka Head Offices who are specialists in this crop. More effective tobacco extension work has been done than ever before by the Department's staff, chiefly by way of the so-called tobacco discussion groups which provide a meeting place for discussions on, and actual demonstrations of, the different phases of the crop. It will be seen from the figures that in all 432 of these discussion groups were held, with a total attendance of 7,496 people—the large majority of whom were farmers—which virtually doubles the total visits made during the year.

There was an increase of over 1,000 visits in all and this reflects increased output by individual officers together with an increase due to more staff being available. The tobacco extension position is an extremely satisfactory one.

As in the past, close contact has been maintained with the Director and staff of the Tobacco Research Board of Rhodesia and Nyasaland, with the Rhodesian Tobacco Association, the Rhodesian Tobacco Marketing Board, the Tobacco Export Promotion Council and, to a lesser extent, with members of the Turkish Tobacco Association.

Nyasaland was again visited by the Chief Tobacco Extension Officer in pursuing the policy of co-operation between the Department of Agriculture in Nyasaland and this Department.

(c) *Land Use Planning*

(i) *General:* The year under review has been one of considerable progress in all fields of the Planning and Training Branch which has already achieved a fine reputation, not only within this Department, but also with other Departments and Governments within and outside the Federation.

(ii) *Aerial Photography:* In keeping with the necessity of having up-to-date photographic cover of the entire European farming area, all areas that were listed for flying this year were duly photographed and a first-class quality cover was obtained. A departure from 1 in 20,000 scale photography was made which enabled a coverage of 9,559 square miles to be achieved at a scale of 1 in 40,000.

An outstanding commitment by the R.R.A.F. of 7,000 square miles was also flown but the standard is unsatisfactory and not comparable with the contract photography for stereo-interpretation and mosaicing purposes.

Localized aerial photography was done by local commercial enterprises for special purposes which included the Umfurudzi Block project, Sabi evaluation photography and the coverage of many individual farms.

(iii) *Farm Planning:* A considerably increased number of plans was produced in all Regions during the year and the demand for this service continues to grow. The following table reveals the position:

Region	*Plans Completed*	*Plans Being Worked On*
Mashonaland (Region)	232	145
(Sabi Team)	65	14
Eastern	83	42
Midlands	169	141
Matabeleland	82	29
	631	371

This output reflects the increasing tempo of production when compared with previous years. For example in 1956-57 and 1957-58 only 68 and 218 plans respectively were completed. The sizes of the units planned, it should be mentioned, vary from 1,000 acres or less in the high-rainfall areas to over 6,000 acres in the drier parts of the country. The Department's staff is now becoming well experienced in this work, which is being given active support and high priority by I.C.A. committees and farmers.

Perhaps a more accurate reflection of the achievement of the Department in this field is given by the acreage that has been accurately classified during the past 12 months in terms of either vegetation in the ranching areas or land capability in the cropping areas:

Region	*Acreage Classified*
Mashonaland (Region)	615,100
(Sabi Team)	212,000
Eastern	267,600
Midlands	951,400
Matabeleland	1,303,000
	3,349,100

The above-mentioned figure of 3,349,100 is 7 per cent. of the European-owned land in Southern Rhodesia. It is anticipated that a coverage of at least 10 per cent. of the European farming area can be achieved in the coming year.

(iv) *Initial Development Planning:* This technique continues to be used both in the opening up of new areas on behalf of the Department of Lands and for rapid overall assessment purposes in more developed areas. Such assessments were produced for the following areas during the year:

Region	*I.C.A.*	*Acreage*	*No. of Farms*
Mashonaland	Eldorado	21,000	7
	S. Ayrshire	42,000	4
	Beatrice	38,000	21
	Darwin	46,000	9
	Karoi South	8,000	2
	Darwendale	51,000	22
	Horseshoe	29,000	15
		235,000	80
Midlands	Enkeldoorn	34,570	5
Matabeleland	Marula	145,000	6
	Matetsi	1,000,000	41 + Crown Land
	Bulawayo Municipal Area	5,000	1
		1,150,000	48 + Crown Land
Eastern	Mtoko	18,000	7
	Inyanga	33,000	1
	Chipinga	17,000	1
	Melsetter	80,000	15
		148,000	24

The 1,567,570 acres covered constitute a threefold increase over the 481,340 acres of the previous year.

(v) *Sabi Catchment Planning:* The planning effort in the European-occupied areas of the Sabi Catchment has continued at the same high pressure as before with the completion of 65 farms totalling 154,000 acres. This compares favourably with the 53 farms and 149,000 acres of the previous year. A high standard of excellence has been maintained which is reflected in the enthusiasm of the farmers

for this work. Except in the case of about 25 farms where apathy exists, planning on all farms within the Wye Dam catchment has now been completed.

In addition to farm planning, the Planning Team undertook reconnaissance surveys of all other I.C.A.s within the Condo Dam catchment to help assess the conservation problems there.

Water conservation continued to rank high in the planning activities of the team, dams and weirs being sited as follows in the Wye Catchment during the year:

I.C.A.	*Dams*	*Weirs*
Wenimbi	14	—
Marandellas West	21	5
Marandellas South	41	3
Wedza	176	12
	252	20

Of these dam sites, assessments have been made of all but 71 by the Sabi Team staff; these 71 dam sites are large—they, together with the weirs, being the responsibility of the Irrigation Department. The overall position in regard to dam sitings in the Wye Catchment may be summarized as follows:

Period	*Dams*	*Weirs*
31st September, 1959 . . .	276	67
1st October, 1958, to 30th September, 1959 . .	252	20
Group Staff Sitings . . .	68	5
	596	92

This constitutes a large potential for water development—approximately five dams and one weir per farm on the average.

Farm planning of 49 farms, covering 180,000 acres, was also undertaken in the Sabi Catchment by local officers in their respective I.C.A.s. Of this area, 76,500 acres (representing 21 farms) fall within the catchment of the Condo.

In order to establish further the fundamental relationships that exist between soils, topography, climate, cultural practices and erosion and run-off losses in the Wye Valley Catchment, two sets of run-off plots have been laid down and complete catchment gauging devices on catchments from 50 acres to 1,000 acres in extent are being installed. Further run-off plots will be established in the area that is to be planned in the future. Information of great importance will be obtained from these measurements.

Initial surveys of the state of protection within the catchment of the Kyle Dam have also been made. These will be elaborated next year.

(vi) *Miscellaneous Planning:* Assistance has been given by the Planning Staff to various Federal Government departments and to certain departments in the Southern Rhodesia Government. For example, the Department of Irrigation was assisted with assessments for compensation arising from the inundation of land, the Department of Lands in regard to settlement in European areas and the Department of Town and Country Planning in regard to subdivisions and suitability of sites for urban development. In addition, assistance in an advisory capacity was given to the Southern Rhodesia Department of Native Agriculture on organizing planning teams, unit planning and on solving certain land-use problems in African areas. The National Parks Board was assisted in planning the Matopos National Park (260,000 acres) and the Ngesi Dam and Sinoia Caves areas.

The planning staff at Head Office undertook the planning of ten farms in conjunction with training courses and special projects, in addition to giving active assistance in planning nine others in a special exercise in the Umfurudzi area. In all, the Head Office Planning staff made over 280 visits during the year.

(d) *Farmers' Days*

No less than 165 field-days organized by I.C.A. committees in co-operation with this Department's officers were held in the four Regions during the year, in addition to tobacco discussion groups to which reference will be made later. These field gatherings on private farms, and occasionally on Research Stations and the two Experimental Farms, were well attended and organized and served a very useful purpose indeed in high-lighting current agricultural problems and their solutions, publicizing new techniques and generally in stimulating discussion to the mutual advantage of all those present.

One of the difficulties associated with these field events is that of encouraging a greater percentage of the less progressive farmers to attend. Invariably the bulk of those who come are the converted. Field officers are only too aware of this fact and, in co-operation with the I.C.A. Committees concerned, are constantly endeavouring to persuade a greater and more representative cross-section of the farming community to support these field-days.

(e) *Shows*

Officers of this Department again took a keen interest in the various agricultural shows held in Southern Rhodesia during the year and organized a departmental stall at each, with the exception of Beatrice. In a great many instances, too, officers assisted as stewards as well as with livestock and produce judging and in several cases served on the organizing committees.

Entries generally were of a high standard, but fewer in number than usual in the case of Umtali and Fort Victoria.

Two new events during the year were the Tobacco Show organized by the Wedza Farmers' Association, and the Gwanda and South-western Districts First Annual Show, both of which were very successful, being well supported by local farmers.

(f) *Conservation Field Visits for Teachers*

On the 18th April, 1959, a new series of one-day conservation outings for teachers was started, the object being to take out into the field as many teachers as possible during the year and show them tangible evidence of the importance of conservation. This series has been gratifyingly successful, 283 teachers having participated in visits during the year.

Questionnaires drawn up by the Department and completed by the teachers revealed that single day outings of the kind at present being organized are popular and that Saturday is the best day of the week on which to hold them.

A fund of goodwill and understanding is being built up between this Department and that of the Federal Ministry of Education, which should do much to ensure the development of overall progress of conservation education in this country.

(g) *Conservation Week*

Conservation Week, held in July, 1959, was the most successful yet organized in Southern Rhodesia, a fact that is due almost entirely to the policy that was adopted of making the teachers themselves, rather than officers of this Department, responsible for talking to school children on Conservation topics. The interest displayed by individual schools in Conservation is reflected in the vast number of books, pamphlets, friezes and posters that were prepared by communal effort on the part of the children and which were subsequently evaluated by a small action sub-committee of the Natural Resources Board's Education Committee.

(h) *In-Service Training*

(i) *General:* Now that the Planning Section is fully established, the imbalance on the training side is becoming apparent, no staff being available for the organization of specific training courses.

During the year the accommodation problem was alleviated by the provision of a lecture hall and, in spite of staff deficiencies, progress was maintained in all spheres; in some cases expanded programmes were undertaken.

(ii) *Initial Training:* All new officers entering the Department were given *ab initio* training in photo-interpretation and topographical draughting and, subsequently, initial training in mechanical conservation work by experienced officers.

(iii) *In-Service Training:* The high standard of training of in-service officers was maintained. Fewer courses, however, were held after the initial backlog requirement for in-service training on specific subjects (particularly Farm Planning) was satisfied. Officers chosen to undergo this type of training have been carefully selected so as to ensure that the best possible use is made of the Department's limited facilities in this field.

All officers have now participated in a course in Farm Planning, the last 15 having been trained during the year on two courses which were also attended by senior officials of other departments and organizations as follows:

Department or Organization	*Number of Representatives*
Department of African Agriculture (Northern Rhodesia)	14
Department of Native Agriculture (Southern Rhodesia)	8
Department of Lands (Southern Rhodesia)	5
Department of Lands (Northern Rhodesia)	3
Department of Research and Specialist Services	4
Tobacco Research Board	2
University of Rhodesia and Nyasaland	1
Fertiliser Agronomists	5
Mission Agriculturists	2
Department of Agriculture, Moçambique	1
	45

This current total brings the number of persons from within and outside the Federation who have been trained in the Department's farm planning approach and techniques to 393. There is no doubt that land-use in this and several neighbouring territories has been placed on a sound and co-ordinated footing in consequence of these courses that have been held.

Training in other fields was restricted in order not to interfere unduly with the work of field officers during the planning season. Only one Irrigation Course was held, this being attended by 20 selected officers and five representatives from other Departments.

A course in Dam Construction was specially organized and run on behalf of the Southern Rhodesia Department of Native Agriculture for 15 of their officers.

(iv) *Farmer Training:* This extremely effective extension channel has been fully exploited during the year. With the assistance of officers from the Department of Research and Specialist Services, 18 Cattle Courses were run (15 on Beef Cattle and three on Dairy Cattle). These, held in all the main centres of the Federation, were attended by approximately 1,100 farmers. In addition to those on Animal Husbandry, three highly successful courses on Irrigation were organized and held, in which 140 farmers participated.

This response, while being most gratifying, has created a demand for many more such courses, not only on Animal Husbandry aspects but on many other lines of agricultural production. To do justice to this demand it is very necessary that the Chief Planning and Training Officer should be given an additional officer to assist him in the training duties for which he is responsible.

(i) *Young Farmers' Clubs*

During the year the Movement, now a Federal Organization, has experienced a distinct increase in determination to overcome its many problems arising from an increasingly critical shortage of full-time Organizers.

It is a credit to the Movement that, in spite of these restrictions, by careful planning and selection of priorities, and with the emphasis on leader training, no less than 15 training courses and study tours were successfully organized and six national projects to promote good land and livestock management were undertaken by many clubs.

The two organizers gave priority to two Regions, Mashonaland and Matabeleland, and here the backlog of the past two years—when only one organizer was available over extended periods due to leave requirements—was overcome with an increase in achievement. In Nyasaland and Northern Rhodesia this was more than overcome by the appointment of an organizer by the Northern Rhodesia Government in August, handling clubs of all races. In Southern Rhodesia a Beit Trust grant to the Department of Native Agriculture now makes the inclusion of African clubs possible. Overall the Movement's strength in Southern Rhodesia rose from 49 to 60 clubs during the period covered by this report, a most encouraging development being the formation of senior clubs in rural areas where most of the members are farm assistants or sons and daughters of farmers.

This Movement is doing most valuable work in its own quiet way, the results of which will be seen in the years to come through the outlook, self reliance and leadership ability of its past members. In the field of conservation its impact on some districts is already being felt and countless parents are well aware of its value. If it is to progress along sound, stable lines, however, and if it is to embrace a majority of the nation's youth, the Movement's essential and limited staff requirements must be met as soon as possible.

(j) *Agricultural Engineering*

The demand for the engineering advisory services continues to increase rapidly and has already reached the point where the available staff is unable to fulfil all the requests of the farming community for advice and assistance.

(i) *Farm Machinery Advisory Service:* The one officer available has been in great demand for providing advice on the choice of suitable equipment and the setting and maintenance of farm machinery. There is no doubt that he will require assistance at the earliest possible opportunity. In the meantime increased use will have to be made of bulletins, field-days, short courses, etc.

A major project this year has been the provision of technical assistance to the Interim Fibre Committee on machinery for use on the harvesting, handling and treatment of kenaf. Addresses and demonstrations on numerous aspects of farm mechanization were given at many field days.

(ii) *Farm Buildings Advisory Services:* Requests for advice from farmers increased from 462 in 1957-58 to 1,079 in the current year. The Farm Buildings Engineer cannot cope with the tremendous demand for his services. Not only will he require assistance as soon as possible, but he will also have to make increasing use of bulletins and leaflets to communicate information to farmers whom he is unable to visit personally.

(iii) *Drainage Advisory Service:* Requests for advice on drainage and water table control that have already been manifested show that this new service will be in great demand and of much value to the farming community. It is the intention to concentrate on research during the first few years before embarking on a major advisory programme.

11. EXPERIMENTAL FARMS

As has been the case in the past, the two Experimental Farms at Chipinga and Karoi respectively have continued to serve a most useful function in demonstrating to landowners in the surrounding areas a balanced system of mixed farming and in acting as the focal point for farmers' days.

A considerable number of experiments were carried out at these farms in collaboration with the Department of Research and Specialist Services. These experiments were well conducted and of great interest and value to local farmers during their individual and organized group visits to the farms. In this connexion it is relevant to mention that, as from the beginning of 1959, the Chipinga Experimental Farm has been divided into a 500-acre Dairy Unit and a 1,100-acre Experimental Section on which all field trials are to be conducted in future.

12. S.A.R.C.C.U.S.

The Chief Planning and Training Officer represented this Department at a Pedological Conference held under the auspices of S.A.R.C.C.U.S. in Pretoria at the beginning of May. The Conference was a great success.

NORTHERN RHODESIA

1. ORGANIZATION

The year under review has been one in which only minor changes had to be made in the organization to enable the process of consolidation to be effected. All the European staff are now on Federal terms of service.

(a) Head Office. The administrative section has been fully organized and, while in some quarters it was considered to be rather lavish, the work can be accomplished efficiently and without undue delay only when all the staff are present. A considerable number of administrative duties have been taken over from the professional staff, thus enabling them to devote more of their time to the work for which they are employed.

(b) *Intensive Conservation Areas.* During the year additional Intensive Conservation Areas were declared on the Copperbelt. They have been gazetted.

The present position in regard to Intensive Conservation Areas is as follows:—

(i) Declared during the year: Two, viz., Ndola/Luanshya and Kitwe/Mufulira.

(ii) Investigated or under investigation for declaration: Nil.

(iii) Subdivided during the year: Nil.

(iv) Investigated or under investigation for subdivision: Nil.

(v) Boundaries changed: Nil.

(vi) Investigated or under investigation for Boundary changes: Nil.

(vi) Investigated or under investigation for boundary changes: Nil. declared to date in Northern Rhodesia. Details are given below:

Region	*Group*	*I.C.A.*
Northern Rhodesia .	Zambesi	Livingstone Zimba (S. Kalomo) Kalomo North Choma South Choma North
	Mazabuka . . .	Monze-Pemba Magoye Lower Kaleya Upper Kaleya Mazabuka Nega Nega
	Lusaka	Chilanga Lusaka West Lusaka East Lusaka North
	Chisamba . . .	Chisamba East Chisamba West Mwamboshi Mumbwa
	Broken Hill . . .	Broken Hill South Broken Hill North Mkushi
	Copperbelt . . .	Chingola-Bancroft Ndola-Luanshya Kitwe-Mufulira
	Fort Jameson . .	Fort Jameson

Districts at present not served by I.C.A. Committees are Abercorn and scattered farms in the Northern, Luapula and North-Western, Central and Southern Provinces.

(c) *I.C.A. Committees.* Most areas can be said to be running efficiently and by and large their enthusiasm is increasing every year. The co-operation between the committees and the field staff of the Department is excellent. There is also a very close and pleasant link between this Department and the Northern Rhodesia Ministry of Natural Resources and Lands and the Northern Rhodesia Ministry of African Agriculture.

The enthusiasm of all concerned in Northern Rhodesia was clearly demonstrated in the remarkable recovery which was made after the disastrous season of 1957-58; only a combined all-out effort could have achieved this transformation.

(d) *Group Organization.* This organization has improved, though there are some Groups which need to be strengthened.

The Group Newsletters are of a high standard and very popular and have served a useful purpose.

2. STAFF

The year was again a particularly happy one so far as the staff position was concerned. The Department, however, suffered a serious loss with the resignation of Mr. W. Pretorius, Senior Tobacco Extension Officer, who resigned to take up farming. His replacement was unable to commence his duties for several months.

On the Experimental Farms the position was not very satisfactory. At Msekera both the superintendent and the manager left; one was replaced almost at once but he was later exchanged with another farm manager from Southern Rhodesia. The second post was not filled for nearly a year. The horticultural manager on the Copperbelt Experimental Farm resigned when the station was transferred from Kambowa to Kitwe, but this post also has now been filled.

The combined post of Dairy and Poultry Officer as taken over from the Northern Rhodesia Government proved unsatisfactory, was abolished and a new post of Poultry Officer created which has been filled.

Several areas still have to share Conservation Officers and whilst the present number of farmers concerned would not, in all cases, normally justify additional staff, the distances to travel between and within areas, together with the great demand for work and the leave problem, indicate that additional Conservation Officers will be required in the near future. The Mkushi Block is being settled rapidly and from some fourteen farmers two years ago there will be in the region of seventy in 1960. Eventually there will be about two hundred farms, when a Group Conservation and Extension Officer with two Conservation Officers will be required. The Department is not at present able to give this area the assistance it requires from an advisory point of view and an officer trained in tobacco is urgently needed.

Work in the two Choma I.C.A.s is falling behind and a second Conservation Officer here, too, is needed badly.

The relief staff of one officer is totally inadequate and at least one more officer is necessary.

The field staff have been augmented during the year by the addition of four African Survey Assistants and four African Field Survey Orderlies. They have proved of great value in hard-pressed areas.

On the administrative side, changes brought about by promotion also took place and the typing position was eased by the addition of an African clerk/typist. The recruitment of typists still proves difficult due to the higher rate of pay offered by commerce and industry.

The following table gives the establishment of the Department in Northern Rhodesia:

EUROPEAN

	Authorized 30.9.58	*Requirements*
Head Office		
Regional Director	1	1
Regional Conservation and Extension Officer	1	1
Senior Animal Husbandry Extension Officer (seconded from Department of Research and Specialist Services)	1	1
Senior Tobacco Extension Officer	1	1
Senior Conservation Engineer	1	1
Irrigation Officer	1	1
Horticulturist (seconded from Department of Research and Specialist Services)	1	1
Poultry Officer (seconded from Department of Research and Specialist Services)	1	1
Soil Chemist (seconded from Department of Research and Specialist Services)	1	1
Senior Executive Officer	1	1
Higher Executive Officer	1	1
Clerical Officers (administrative)	5	5
Stenographer	1	1
Typist	1	1
Clerk	1	1
Planning Team		
Planning Officer	1	1
Conservation Officers	2	2
Agricultural Topographers	2	2
Field Staff		
Additional Regional Conservation and Extension Officer	1	1
Group Conservation and Extension Officers	8	9
Conservation Officers	16	22
Animal Husbandry Officer (seconded from Department of Research and Specialist Services)	1	1
Experimental Farms		
Managers, Supervisors and Assistants	7	8
Working Account		
Accounts Staff		
Higher Executive Officer (seconded from Ministry)	1	1
Clerical Officers (seconded from Ministry)	2	2
Stores Officer	1	1
Engineers, Supervisors and Mechanics		
Mechanical Engineer	1	1
Senior Mechanical Supervisor	1	1
Mechanical Supervisors, Mechanics	Variable according to volume of work from time to time.	
Branch III		
Survey Assistants	14	14
Clerks	6	6

Branch IV	*Authorised 30.9.58*	*Requirements*
Senior Agricultural Capitao	1	1
Agricultural Capitoa	4	—
Orderly	1	1
Telephone Operator	1	1
Field Survey Orderlies	25	30
Handyman	1	—
Bricklayer	1	1
Driver	1.	1
Other posts (ungraded)		
Eurafrican Assistant	1	1
Orderlies	3	3

(a) *Visits to Other Countries.* (i) The Planning Officer (Mr. J. Mackenzie) completed on the 28th November, 1958, the study tour of the United States of America that was made possible by the International Co-operation Administration of that country. He benefited greatly by his visit which was, essentially, designed to help him study at first hand the broad field of Land Use Planning, Land Classification and Farm and Ranch Planning as carried out in the U.S.A.

(ii) The Regional Conservation and Extension Officer (Mr. A. N. Beaumont), through the co-operation of the Ford Foundation, left for a four months' tour of the U.S.A. on the 5th March, 1959. The object of this visit was to enable him to study:

(1) Extension methods at all levels, including organization, evaluation and leadership.

(2) Modern methods and techniques of intensive dry-land crop and soil management.

(3) Techniques of livestock management and the integration of livestock in the farming systems of the higher rainfall areas.

(4) The employment of aerial photography in land capability classification and land use planning.

(5) The techniques of farm and catchment scheme planning in maize and tobacco growing areas.

Mr. Beaumont, in addition, spent approximately three weeks attending an International Meeting on Methods and Programme Planning in Agricultural Extension at Wageningen in the Netherlands during July, 1959, before concluding his overseas trip by visits to various dairy farms in England in August. He returned to Rhodesia on the 15th August, 1959.

(iii) The Additional Regional Conservation and Extension Officer (Mr. E. L. G. King) left for the U.S.A. on the 20th May, 1959, for a four months' study tour of that country under the auspices of the Food and Agricultural Organization of the United Nations. The objectives of his tour were essentially the same as those in the case of the Regional Conservation and Extension Officer [(ii) above].

Mr. King completed his American trip on the 25th September, proceeding from Washington on that day for a short tour of farms and agricultural institutions in the United Kingdom and Holland.

Belgian Congo. The Regional Director and the Senior Animal Husbandry Extension Officer paid a short visit to the farming areas and research stations in the Elisabethville area of the Haut Katanga of the Belgian Congo during the period 27th to 30th January, 1959. The object of the visit was to obtain information on the system of land allocation and tenure in use, the agricultural research work in progress, the type of agriculture practised on commercial holdings, and the system of marketing employed.

(b) *Departmental Committees.* The Regional Director served on the following Committees during the year:

(i) Farmers' Debt Adjustment Board (Member).

(ii) Agricultural Lands Board (Member).

(iii) Eastern Province Loans Co-ordinating Committee (Member).

(iv) Tsetse and Trypanosomiasis Committee (Member).

(v) Natural Resources Board (Advisory).

(vi) African Affairs Sub-Committee of the Natural Resources Board

(vii) Education Sub-Committee of the Natural Resources Board (Member).

(viii) Drainage Sub-Committee of the Natural Resources Board (Member).

(ix) Regional Planning Sub-Committee of the Natural Resources Board (Member).

(x) Copperbelt Special Area Advisory Committee to Minister of Natural Resources and Lands (Member).

(xi) The Eastern Province (Crawford) Committee (Member).

The Senior Tobacco Extension Officer served on the:

Eastern Province Loans Co-ordinating Committee (Member).

The Senior Animal Husbandry Extension Officer served on the:

(i) Livestock Improvement Committee (Chairman).

(ii) Livestock Improvement Board (Member).

Other Committees and Boards served by officers were:

(i) Regional Planning Sub-Committee of the Natural Resources Board—Regional Conservation and Extension Officer and Planning Officer (Advisory).

(ii) Water Board of Northern Rhodesia—Irrigation Officer (Advisory).

(iii) Southern Rhodesian Sabi Catchment Technical Advisory Committee—Planning Officer (Member).

(iv) Copperbelt Lands Advisory Committee—Additional Regional Conservation and Extension Officer (Advisory).

In addition to these, officers attended meetings of the Provincial Teams in certain Provinces and the Natural Resources Sub-Committee of Provincial Teams, meetings of Councils and Commodity Committees of the Northern Rhodesia Branch of the National Farmers' Union and have assisted the committees of various Agricultural Show Societies.

(c) *Conferences.* An informal Conference at Lusaka of Hydrological Engineers of Central and Eastern Africa was attended by the Regional Director and Senior Conservation Engineer. The Regional Director also attended the 6th Meeting of S.A.R.C.C.U.S. held in Moçambique.

3. TRANSPORT

The transport position has been satisfactory, as practically all the officers used private vehicles, which is a most satisfactory arrangement.

The official transport which was taken over from the Northern Rhodesia Government is now rapidly deteriorating and replacements are being made, but more will be required during the next two years. These vehicles have to operate under severe conditions in the Mkushi Settlement Scheme and consequently wear and tear are high and first-class vehicles must be used if field efficiency is to be maintained.

4. EXPENDITURE

Vote 41	Northern Rhodesia	1958/59		1959/60 Authorized and Anticipated Expenditure
		Authorized	Actual	
		£	£	£
A	Salaries and Wages	86,558	85,991	90,975
B	Subsistence and Travel	7,080	6,085	7,410
C1	Books and Periodicals	70	43	70
C2	Camp Equipment	170	166	100
C4	Leave Entitlements	970	932	920
C5	Office and Miscellaneous	1,740	1,607	1,740
C6	Purchase and Upkeep of Technical Equipment	380	395	280
C7	Recruiting Expenses	50	38	—
C9	Water, Light and Sanitation	130	35	130
—	Post and Telegraph Charges	1,630	1,429	—
E1	Conservation Works and Measures	1,300	2,136	1,400
F	Conservation Working Account	580	487	500
G1	Chalimbana Experimental Farm	5,330	5,534	5,140
G3	Copperbelt Experimental Farm	6,720	6,577	7,060
G5	Mochipapa Experimental Farm	5,630	5,051	5,310
G6	Msekera Experimental Farm	5,650	4,891	4,640
H	Transport and Equipment	24,800	25,098	24,150
—	Housing	4,000	3,575	—
	TOTALS	£152,788	£150,070	£149,825

5. GENERAL AGRICULTURAL CONDITIONS

(a) *Climatic Conditions and General*

The year under review was considerably better than the previous disastrous one, but certain areas suffered drought conditions early in the season which delayed planting and some areas had drought conditions towards the end of the season,

while others had excessive rains—parts of Chisamba recorded over sixty inches of rain. By and large, however, the season can be classed as satisfactory.

(b) *The Financial Position*

(i) *The Farmers' Debt Adjustment Board* received, up to the 9th July, 1959, some fifty-eight applications from farmers to come under their protection, of which nine were not accepted. In addition, over two hundred were given protection under the "voluntary" scheme.

Further applications are being received for the 1959/60 season and a few of those helped in 1958/59 have not been able to satisfy the Board and will go into liquidation.

In its first year the Board was lenient with the applicants and every effort has been made by the Board, Co-operative Societies and the Department of Conservation and Extension to improve the finances of the farmers concerned. It is a long-term programme and while one or two of the farmers should cease to require the protection of the Board after two or three years, several will take much longer.

Trade and Commerce as a whole have also co-operated very well. The amount of travelling as a result of all the additional work done advising farmers under the Board strained the vote considerably.

(ii) *Fort Jameson.* This area also enjoyed a fairly reasonable season from a climatic point of view and a change of heart occurred among the farmers who made a determined effort to improve their position. The loans were granted this year with a strong warning that those who failed to repay their 1958-59 seasonal loan and a proportion of the back debts, should not receive a loan for the 1959-60 season, even though they might be given a stumping loan in February, 1959. All the members of the Eastern Province Loans Co-ordinating Committee except one visited the area early in the year and as usual excellent crops were seen in the field. At the first sales the presentation and grading showed a remarkable improvement. The quality of the tobacco unfortunately fell off at the later sales and it is feared that about ten to fifteen farmers will not be able to make the necessary repayments. Quite a number of the others, however, have greatly reduced their indebtedness. There is no question that, given a reasonable season, hard work and attention to detail, growers cannot make a profit in the area, the potential of which must not be judged by the standard of the inefficient farmer. A few of the successful farmers are leaving or have just left the area for Southern Rhodesia or the line of rail. There will be about thirty farmers left in an area with a potential of 400 to 500 farms.

(c) *Crop Production*

(i) *Food Crops: Maize.* Maize yields throughout the country were good but not as high as was hoped for due to the sudden cessation of the rains at the end of summer which seriously reduced the yields of late-planted crops. The standard of crop management was high and there was a marked improvement in the plant populations which, to a large extent, offset the effect of the previous bad season and the fact that much of the maize was grown on land which had not previously grown a green manure crop. Certain areas suffered financial losses through a high percentage of diseased or discoloured grains in their final threshed samples.

In the better maize growing areas yields of up to 30 bags/acre are now being achieved and the general average is rising steadily.

Waterlogging in arable lands is a problem which is receiving much attention and ridge and furrow layouts are being installed. At the same time farmers are being advised to pay much more attention to soil management and in particular the provision of organic matter.

Sorghums. Interest is being shown in sorghum production and a small acreage was grown in the Livingstone area.

Groundnuts. At present hardly any groundnuts are produced, but farmers looking for alternative cash crops are beginning to consider this crop. Trials to date have shown the need for the right soil conditions.

Legumes. The acreage of potatoes grown under dry-land conditions as a summer crop increased and good results were obtained in the case of Pimpernel, although the crop was not well received by the consumer.

The winter crop under irrigation has also increased and, as anticipated in the last annual report, the supply of locally grown potatoes will exceed the demand towards the end of the year.

The shortage of good quality disease-free seed is a major problem confronting potato growers and many have suffered through using diseased seed and are now faced with having to throw land out of production due to the incidence of disease such as Bacterial Wilt.

A definite improvement in crop management has taken place, with a corresponding increase in yield.

Wheat. The acreage of wheat grown has expanded mainly in the Lusaka area, where farmers are accustomed to growing the crop and have the land and facilities available.

Yields have averaged about seven or eight bags/acre, with isolated cases going up to twelve bags/acre.

The potential for irrigated wheat in the Mazabuka, Lusaka and Chisamba areas is considerable.

Vegetables. Production tends to be centred around Lusaka and the Copperbelt. Due to improved techniques and the availability of effective fungicides, summer production is improving, particularly so in the case of tomatoes.

The market was flooded in July with good quality cauliflowers and other brassicas reached a peak of production towards the end of July. Aphid infestations have been particularly marked due to the mild winter and Bacterial Black Rot of brassicas is assuming increasing importance.

The production of root crops during the summer did not meet the demand although supplies did increase during the winter. In the case of carrots, summer production was affected by disease.

Good yields of onions were obtained and the crops began coming on to the market in August.

Citrus and Sub-tropical Fruits. There are now some 65,000 to 70,000 citrus trees established in Northern Rhodesia. The quality of the oranges has been excellent, but in the case of naartjies much dry, tasteless fruit was produced and growers will have to improve their fertilizing techniques in order to improve the quality.

Bananas are being successfully produced in the dry season, but the annual yields are low due to "choke throat" and peel splitting which occur at the end of the dry season in the hot dry September/October period.

The production of avocadoes has increased and a glut occurred in February and March. Papaws have been produced in reasonable amounts and have been readily absorbed by the local markets.

(ii) *Cash Crops: Tobacco: Flue-cured.* Considerable progress was achieved during the past season and a substantial increase in the weight grown per acre resulted in yields of over 1,000 lb. per acre being not uncommon in the country at large.

Generally the standard of management of the seed-beds was high and the modern recommended methods were fully accepted. Mulch was widely used—it is doubtful, in fact, whether a single seed-bed in Northern Rhodesia was under cloth. The seeding rate of 1 oz. per 400 sq. yds. in many cases proved to be too thick. The prejudice against methyl bromide resulting from failures in the past due to incorrect application is being broken down. The watering of the seed-beds was not always satisfactory and "cupping" resulted from watering too often and too lightly. The use of water carts for seed bed watering is being widely adopted as it gives a good control of the water applied and also a greater flexibility in the selection of seed bed sites which need not be adjacent to a water supply. Spraying is generally carried out as recommended, although there is a tendency to concentrate on spraying for Anthracnose and to neglect the spot diseases.

Land selection has received increasing attention and is being based upon soil pit examination. In the Broken Hill, Mkushi and Fort Jameson areas in particular, more attention is being given to the late ploughing of soils with heavy subsoils. Trouble caused by the late release of nitrogen has been experienced in all areas.

In the flatter country around Broken Hill and Chisamba the need for surface drainage has been realized.

Some 80 per cent. of the North-Western Rhodesia crop was planted by the end of November and by the middle of December 95 per cent. of the crop had been established. In all areas water planting is accepted except in Fort Jameson, where it is still regarded with suspicion. The example of the better farmers in this latter area is, however, doing much to break down this resistance.

The importance of correctly topping and suckering is being continually stressed and during the past season where the plants were topped early and fairly low, good results were obtained, but topping was often too late and too high and suckering neglected.

Little use is being made of tying machines in the lands during reaping, but the idea is beginning to take on. There was a tendency to reap green where spot diseases were serious and this resulted in green leaf.

More and more use is made of the hygrometer during curing and more use should be made of steam to colour as spot is a serious problem. In many cases the limiting factor is the poor standard of construction of the barns and furnaces.

The increased yields per acre were not always fully realized due to a shortage of barn accommodation and handling facilities. A large proportion of the crop is still commercially graded and in some instances the grading received unfavourable reports from our representatives on the Tobacco Floors. Considerable time was spent in correcting mistakes of these commercial graders and the season ended with an improvement in commercial handling. However, more farmers are now considering farm grading and the interest shown in the talks and discussions held during the past winter on tobacco buildings points to the fact that growers appreciate that any improvement in their cultural practices must be balanced by an improvement in their handling facilities.

Insect pests were not of very great importance and are being controlled. Rosette and the new virus disease attacked late-planted tobacco and in some cases resulted in a complete crop failure. Frogeye is the most serious disease in the lands.

Turkish Tobacco. This crop is attracting the attention of the small-holders who generally handle the crop in a far better manner than the large-scale farmers.

The earlier plantings did well, but due to the abrupt cessation of the rains, February plantings produced poor yields.

Grass and Vegetable Seed Production. Thirteen farmers attempted to grow vegetable seeds and generally the results have been most disappointing. This is a very specialized type of production and these results emphasize the need for attention to detail and the provision of advice on the subject. Seed potato production was carried out with encouraging results by four growers. Eelworm infestations present the major hazerd to production. Grass seed production is progressing and good yields are being obtained, particularly of Giant Rhodes.

There is an urgent need for specialist staff to advise on seed production and to provide the necessary inspectorate if this line of production, which offers great scope, is to be expanded on sound lines to produce an article readily acceptable on world markets.

(iii) *Fodder Crops.* Much serious thought is being given to the provision of adequate amounts of home-grown feeding stuffs, particularly for dairy cattle.

Grass leys are being established on an ever increasing scale and generally either Giant or Katambora Rhodes Grass is being employed.

Protein-rich crops are required to replace purchased feeding stuffs and the acreages under legume hays and grains are being increased. The results obtained from Pigeon Pea are most encouraging. This crop is proving to be adapted to a wide range of soil conditions, requires little fertilization and provides valuable grazing during the winter months. Jack beans are also proving their value as they can be early-planted and yet, being a crop requiring a long growing season, do not mature until after the termination of the rains when hay or seed can easily be harvested. Under irrigation, lucerne production is increasing and farmers are also turning to crops such as cabbages and kale for mid-winter green feed and maize planted in late July for October and November feeding.

(d) Livestock Production. The past year was a favourable one for livestock.

(i) *Cattle: Beef Cattle.* Interest in beef production has increased during the past year due in part to rapid expansion which has taken place in dairy farming and the consequent fear of over-production of milk. At the same time expansion has been retarded as the effectiveness of the existing marketing facilities was uncertain, but the setting up of the Cold Storage Commission in Northern Rhodesia will overcome this as a residual buyer will in future be available.

A series of two-day intensive beef courses held throughout the country in conjunction with the Department of Research and Specialist Services were well received and have done much to bring home the need for adequate winter supplementation of beef stock if economic production is to be achieved.

Many farmers are now using urea/molasses mixtures as a protein supplement on low quality roughages with good results, but attention will have to be paid to the conservation of these roughages as in certain cases inadequate amounts are available due, all too frequently, to the ravages of veld fires. In many herds the

standard of management has improved and routine practices such as seasonal breeding and a fixed weaning period are being implemented.

Outbreaks of trypanosomiasis have occurred in the Lusaka, Chisamba and Choma areas and have caused concern. This emphasizes the need for ring fencing all livestock holdings so that the movement of cattle within an area can be controlled: the Regional Planning Scheme is, where possible, being accelerated so that farmers will be provided with finance for this most important control measure.

Dairy Cattle. Milk production has again shown a tremendous increase due very largely to improved management and feeding. When it is realized that production has increased from 308,000 gallons per year in 1951 to 3,118,000 gallons per year in 1959, and that in the past three years it has doubled, the expansion can be appreciated and also its effect upon the marketing arrangements. Although the management of the milking herds has improved, in all too many cases the rearing of the replacements leaves much to be desired and efforts will have to be made to provide better housing and greater amounts of good quality home-grown roughages. With the profit margin decreasing, producers will be obliged to pay more attention to production per cow, and with the aid of the Milk Recording Scheme the culling of poor producers and their progeny will have to be intensified.

Whereas in the past any shortfalls in the production of roughages could be made good by the use of purchased feeding stuffs, in the future self-sufficiency as far as is possible must be the key note.

(ii) *Sheep.* Interest is beginning to be shown in sheep, which with reasonable care and attention do well. A few flocks of Dorper ewes have been imported during the past year; some unfortunately suffered losses as they were imported at the beginning of the rainy season instead of the dry winter period.

(iii) *Goats.* Flocks of goats are run on some farms and with few exceptions do extremely well. An increased number of Boer goat rams have been imported during the past year.

On many farms a small flock could be run as a source of meat and also as a weapon against bush encroachment.

(iv) *Pigs.* Several of the smaller pig producers have gone out of production during the past year and very few new producers have come in.

With only a very small amount of cheap, low grade maize on offer producers have been trying alternative feeding stuffs in order to reduce their costs of production. Where available, dried or wet brewers' grains are being used with good results for this purpose.

(v) *Poultry.* Little improvement can be reported during the past year.

The quality of table birds produced varies considerably and the fluctuations in production make marketing arrangements difficult. The standard of housing in certain cases needs considerable improvement, a fact that has been appreciated; generally, well constructed houses are now being erected.

The main improvement required is one of general management and hygiene.

(vi) *Good Cattle Production Bounty.* A total of 286 farmers applied for bounty in the year ending 30th June, 1959, of which 272 were approved, the money paid amounting to the sum of £39,148. This was an increase over the previous year due to the fact that a number of cattle presented for bounty in 1957-58 were too young and therefore not branded, but became eligible in the 1958-59 season, thereby increasing the number for inspection.

In 1959-60 season all yearlings presented for bounty must be properly dehorned and although farmers were warned of this in 1957, some have failed to comply with the result that expenditure is expected to fall.

(vii) *Livestock Improvement Scheme.* This Department continued to administer the scheme with the advice of the Livestock Improvement Committee.

As a result of the poor season in 1957-58, importations of cattle in the latter half of 1958 were not very great and the quota granted by the Union Government for the importation of female stock from the Union of South Africa proved to be more than adequate.

In 1959 the Union Government removed the quota on pedigree female stock as well as on approved grade female stock, but for the purpose of control and guidance the Livestock Improvement Committee agreed to allocate Essentiality Certificates up to the following totals:

Grade Dairy Females	500 head
Grade Beef Females	65 head
Pedigree Dairy Females	120 head
Pedigree Beef Females	50 head

The demand so far has not exceeded these figures. No restrictions were placed upon the exportation of pedigree bulls from the Union of South Africa by the Union Government.

Application for grants under the Livestock Improvement Scheme numbered 87, of which 73 were approved involving an expenditure of £3,550. Grants were approved on the following livestock:

Pedigree Dairy Bulls	35 head
Pedigree Beef Bulls	17 head
Grade Dairy Bulls	5 head
Grade Beef Bulls	41 head
Pedigree Dairy Females	36 head
Pigs	4 head

The payment of a 25 per cent. railage rebate on the charges involved in importing approved breeding stock was continued.

The Friesland Cattle Breeders Society and the Africander Cattle Society Inspectors visited their members in Northern Rhodesia. Inspection of Jerseys and Ayrshires will be carried out in the future by this Department.

6. PRODUCTION FROM IRRIGATION

During the year general progress was good and the area under irrigation increased by about 15 per cent.

Some 70 per cent. of the area in Northern Rhodesia under irrigation lies in the Lusaka and Mazabuka Groups, but the existing acreage is very far short of the immense potential of the country. Development is hampered by the lack of an economic crop which can be grown on a large scale without fear of over-production.

An improvement of irrigation methods and layouts was noted during the year and further improvement could be effected by a series of short courses for farmers.

Water Boards. The Irrigation Officer attended seven Water Board Inquiries in a technical capacity and also as a nominee of the Director of Agriculture.

Kafue Pilot Polder. There has been a marked improvement in irrigation techniques during the year and more attention has been paid to the need for correct surface drainage of these soils. The efficiency of flood irrigation on correctly laid out fields was especially noticeable. Experimental work continues and considerable progress can be expected over the next few years.

Crops and Rotations. Milk, potatoes and citrus are now in a state of over-production and the area under vegetables continues to fluctuate widely due to erratic marketing conditions. Potatoes were seriously over-produced, an added complication being that average yields of the winter crop rose from 60 to 100 bags per acre. The production of vegetable seed and the growing of lucerne hay as a cash crop appear to the most stable irrigated crops for future expansion.

The main criticism of irrigation in Northern Rhodesia is the lack of proper crop rotations. On the older schemes a deterioration in soil structure as well as a build-up of plant diseases is taking place. This is not only due to continuous cropping but to the fact that the soil is continually wet (irrigation in winter and heavy rainfall in summer). It appears imperative for farmers to introduce a dry-land grass ley into the rotations as the most economical means of controlling disease and building up structure and fertility for future cash crops.

7. SOIL CONSERVATION

(a) *Arable Areas*

(i) *General.* Slow but steady progress is being maintained in the protection of arable lands. With priority being given to Stage I of Regional Planning, very little time is being devoted to pegging which is being concentrated into the months of September, October and November. It is important to complete soil surveys wherever possible in the dry season.

Regional planning has revealed that land selected in the past has been poor and farmers are now becoming very aware of the necessity for soil classification as the basis of land selection.

One of the chief problems in Northern Rhodesia has been the inattention paid by farmers to maintaining the humus in their soils, which are tending to become "dead". No amount of artificial fertilizer will produce satisfactory crops, especially on the soil with a high percentage of silt, unless there are liberal amounts of organic matter ploughed in. Grass leys well stocked with cattle and/or sheep are essential. It is hoped that with the operation of the grazier and weaner schemes of the Cold Storage Commission, with the fencing facilities under Regional Planning and the advice of this Department the position will be rectified. There is, however, very little time left as the position is becoming serious.

(ii) *Mechanical Protection of Arable Lands.* Due to emphasis being placed upon regional planning, there was a decrease during the year in most works as shown below:

Group	Contours Distance (in yards)	Storm Drains (in yards)	Roads (in yards)	Waterways (in yards)	Irrigation Furrows (in yards)
Copperbelt/Broken Hill	28,790	4,330	143,900	—	4,410
Chisamba	57,530	11,700	10,100	10,360	2,100
Lusaka	122,607	34,999	76,600	43,050	20,056
Mazabuka	81,500	82,700	—	9,563	11,580
Choma	92,193	—	9,200	470	200
Kaloma	190,110	—	60,380	400	1,000
Fort Jameson	181,592	1,905	1,420	—	180
TOTAL 1958/59 . .	754,322	135,634	301,600	63,843	39,526
TOTAL 1957/58 . .	1,175,373	100,673	399,144	50,283	102,618

In addition to these works a considerable number of contour surveys were carried out for the implementation of drainage systems on land.

Fields were laid out according to conservation principles and a total of 4,079 acres of land were stumped for farmers by the Mechanical Units of this Department.

(iii) *Roads.* The correct alignment and drainage of all roads still plays an important part in the work of the Department. A total of 120 miles of farm and district roads were realigned or new roads surveyed.

(iv) *Drainage.* The difficult Molendemo area was surveyed in great detail by officials of the Department of Water Development and Irrigation and this Department and a Stage I plan prepared, passed and implemented just before the rains in 1958. The lower Kaleya region was also surveyed and, with the Chongwe area, had Stage I plans prepared and implemented in 1959. Thus three of the major drainage problem areas were adequately dealt with by the Department.

The other problem areas of East and West Chisamba received a certain amount of assistance on individual farms; detailed surveys are now in progress and an attempt is being made to try and implement at least one Stage I plan before the 1959-60 rains.

The assistance of an experienced officer from Southern Rhodesia in connexion with ridge and furrow layouts without question convinced the farmers in the North of the great benefits this system can afford. Ridge and furrow layouts were implemented on 3,358 acres during the past season.

(b) *Grazing Areas*

(i) *General Management.* Definite progress has been made in providing facilities for veld management, and this progress can be attributed largely to the impetus given by means of Regional Planning and Good Cattle Production Bounty loans and subsidies for fencing and water supplies. Although progress has been made in this direction and numerous paddocks constructed, more emphasis must still be placed on correct management of the veld within these paddocks. Winter grazing areas in certain localities are being over-grazed at the wrong time of the year, thus causing deterioration of the grasses. An increased number of watering points within the paddock will also have to be provided.

(ii) *Veld Fires.* A big drive was made in this connexion to try to reduce the incidence of veld fires and some of the I.C.A. Committees which undertook this work achieved good results. The Natural Resources Board placed the responsibility

of fire control on the farmers, but also drew the attention of other responsible bodies, such as Native Authorities, Crown Land Administrators and Railway Authorities to their own responsibilities. There is still need for increased penalties in respect of persons found guilty of causing indiscriminate veld fires.

(iii) *Bush Encroachment.* In connexion with *Lantana camara* a determined effort has been made by the Natural Resources Board to publicise the danger of this plant; advertisements in the Press and cinema have been of a high standard and some progress has been made in towns in eradicating lantana, but whilst a few farming areas are making an attempt to eradicate it, others are still far too complacent as to the danger it presents.

Bush encroachment in grazing areas is becoming an extremely serious problem which, if faced now, can be remedied, but if delayed will become a costly operation to perform. The need for correct stocking rates, annual rest periods and hot late burns is being widely publicised, but as yet farmers are not facing up to the dangers which lie ahead.

8. WATER CONSERVATION

The following table shows particulars of the dams built in various Groups during the year.

DAMS AND WEIRS 1958/59

Group	*Farmer Built*		*Government Built*	
	No.	*Capacity*	*No.*	*Capacity*
Kitwe/Broken Hill	7	13,000,000	2	16,500,000
Chisamba	—	—	—	—
Lusaka	3	46,000,000	2	11,500,000
Mazabuka	1	2,000,000	3	17,000,000
Choma	—	—	5	133,000,000
Kaloma	—	—	14	97,000,000
Fort Jameson	1	750,000	—	—
TOTALS	12	61,750,000	26	275,000,000

	Total Number Dams Constructed	*Capacity (Gallons)*
1957/58	58	162,290,000
1958/59	38	336,750,000

Although the total number of dams constructed during the year was less than in the previous year the amount of water impounded exceeded the total for 1957-58.

This aspect of conservation is not progressing as rapidly as it should and a series of drier years will find many stock farmers short of water supplies.

9. MECHANICAL UNITS

(a) *General Remarks on Staff*

All Working Account employees have now accepted Federal conditions of service and their salaries have been converted accordingly.

Three new supervisors were recruited during the year to make up for wastage during the previous year. These additions were necessary because of an increase in the work available to the units and also to enable tractors to be employed in smaller groups—thus making it possible for movement costs to be reduced.

In workshops, one mechanic was replaced and the Stores Officer reverted to the Northern Rhodesia Government, being replaced by a Federal Officer.

The changes have all been for the better and, with one or two exceptions, the staff position is now very satisfactory. There is an excellent spirit amongst mechanics and supervisors, this being reflected in the tremendous improvement that has taken place in the operation of the Working Account.

African staff has remained fairly static, and the reductions in the previous year represent the practicable limit of economies that can be made in this direction.

(b) *General Report on Tractor Groups*

(i) Equipment:

10 Caterpillar D7 tractors
1 Adams Motorized Grader
8 No. 70 Scrapers

7 Rippers
1 Towed Grader
2 Bush Clearing Chains
3 Tree Dozing Stingers
1 Low Loader
6 Lorries
plus minor equipment and light vehicles.

During the year five tractors were boarded and replaced. The new tractors are achieving, through reduction in breakdowns, from 50 per cent. to 100 per cent. more hours than the older ones, besides performing their duties at lower cost. This factor has contributed largely to the greatly improved efficiency of the organization.

The success of bush clearing by chain led to the purchase of a second chain, with a third on order. In addition, three "Stingers" have been designed and built up in Workshops, mainly from scrap, and have contributed, if anything, even more than the chains to better clearing.

(ii) *Work Done.* The major single project undertaken was again on the Mkushi Land Settlement Scheme. Work consisted of bush clearing and the construction of roads and one earth dam.

Extensive bush clearing was carried out for the Department of Tsetse Control. As a result of the success of the work there is every hope of considerably more employment of this nature in the future. Construction of dams, storm drains, contours and roads was carried out under the Molendemo, Matesi, Sibanyati, West Kaleya and Kazengula Regional Plans. Extensive bush clearing was also carried out for private applicants in Chisamba, Choma, Kalomo, Mkushi and Zimba areas. The agreement by Treasury to special deferred terms for this work came just in time to provide full employment in the wet season, but not quite early enough to allow all programmes to be completed.

All told, the year has been a most successful one for the Department's units. After a spell of unemployment early in the year, the tractors became more and more fully occupied and working hours showed a rapid increase. Standard of the work is also high, and the units now enjoy an excellent reputation throughout the country.

(iii) *Workshops.* The Workshops have continued the improvement started last year. Prompt attention is being given to breakdowns and useful equipment is being successfully designed and made in the shops.

Electric power has now been laid on from Lusaka and will shortly be connected up. This should lead to lower costs and improved services.

(iv) *Analysis of Working Hours.* Working hours increased by 2,800 compared with last year's figures and amount to 55 per cent. of available hours. This percentage has been depressed by the inclusion of the motorized grader, which only now has come into full operation. The tractors achieved an average output of 123.5 hours per month (compared with last year's figure of 96.8) but the grader only 67.8, giving an overall average of 117.2 hours per machine month. The breakdown of hours is as follows:

Normal Working Hours	26,940	
Overtime Worked	2,595	
Gross Available	29,535	
Less Servicing Hours	3,318	
Net Available Hours	26,217	100%
Hours Worked	14,418	55·1%
Hours Lost		
Moving	1,783	6·8%
Unserviceable	5,339	20·3%
Weather	1,064	4·1%
Awaiting Work	2,090	8·0%
Other Causes	1,493	5·7%
TOTAL	26,217	100%

These figures show the big increase in efficiency as compared with last year. In practice, the upward trend became particularly noticeable in the latter half of the year and, if it continues, should make very pleasant reading in the next report.

(v) *Financial Statement.* While a full statement is contained in the Auditor-General's Report for 1958-59, it must be recorded that the losses incurred by the Working Account were as follows:

Year ended 30th June, 1956	...	£50,484
Year ended 30th June, 1957	...	£45,357
Year ended 30th June, 1958	...	£11,445
Year ended 30th June, 1959	...	£23,046

The loss during the year under review was due mainly to a lack of work during the first four months, although here advantage was taken of this slack period to overhaul the machines. Customs duty paid on certain of the purchases and amounting to £1,955 was not claimed during the year ended 30th June, 1959. There are reasonable prospects of the fund financing its operating costs from its revenue during the year which commenced 1st July, 1959, as a result of certain economy measures, the acquisition of several new machines, the advance planning of works under the Regional Planning Scheme, and the increased work expected from "line of rail" farmers.

(c) *General Remarks*

The year under review has been a satisfactory one. In spite of the increase in Working Account losses, the organization at last seems to be on a good footing and there is every prospect of its being economic in the coming year. The hopes expressed in the last report of an improved service to field officers has been largely realized, particularly in the important aspect of Regional Planning.

10. FIELD TRIALS

A wide range of trials and demonstrations were carried out in conjunction with farmers and the Department of Research and Specialist Services and these aroused considerable interest. Several I.C.A. Committees have asked for the trials to be continued and for specific demonstrations to be carried out during the coming year.

The following trials and demonstrations were carried out in the 1958-59 season:

Maize Variety Trials	5
Maize Fertilizing Trials	5
Groundnut Fertilizing Trials	3
Kenaf Demonstrations	4
Soya Bean Variety Demonstrations	5
Lucerne Variety Demonstration	1
Irrigated Winter Pasture Demonstration	1
Urea Feeding Demonstrations	2
Burley Tobacco Demonstrations	4
Wheat Variety Trial	1
Potato Variety Trials	3
Ridge and Furrow Demonstrations	3
TOTAL	37

Not all of the trials were brought to a successful conclusion due, in the case of groundnuts, to poor soil conditions which made the harvesting of the crop extremely difficult and in other cases to uneven germination of the seed. In the coming season a similar range of trials and demonstrations will be laid down but more emphasis will be placed on demonstration rather than critical experimentation.

11. ADVISORY SERVICES

(a) *General*

Every year this aspect of the Department's work increases considerably, indicating that farmers are seeking advice and guidance to a much greater extent than in the past. In addition, a great deal of advice is being given to various Departments of the Northern Rhodesia Government and other bodies such as the Co-operative Societies, the Agricultural Lands Board, the Land and Agricultural Bank and other banks.

From time to time, staff of the Department of Research and Specialist Services visited Northern Rhodesia to assist with special problems, or to give talks at field days. Their assistance was greatly appreciated but the number of visits should be increased so that they can obtain a better appreciation of the conditions that obtain in the North.

(b) *Visits made by Officers of the Department*

Meetings Attended	1957/58	1958/59
1. I.C.A. and Group Meetings	357	353
2. Farmers' Association	94	98
3. Road Board	58	28
4. Staff — Groups and Regional	189	141
5. Agricultural Land Boards	45	32
6. Visits with Committee Members	139	125
7. Young Farmers' Clubs	74	56
8. Miscellaneous	45	383
9. Natural Resources Board	28	54
10. Regional Conferences (Salisbury)	10	8
11. Farmers Debt Adjustment Board	6	35
12. Credit Co-ordination Committee	5	—
Inspections and Visits		
1. Regional Planning	440	857
2. Other Conservation Subsidies	13	74
3. Water Board	46	41
4. Agricultural Lands Board	286	233
5. Livestock Improvement and Good Cattle Production Bounty Schemes	503	250
6. Cattle Bank	23	16
7. Dairy Bonus	93	12
8. Land Bank	50	55
9. Seed Association	27	66
10. Tobacco Grading Sheds	68	82
11. Pest Control	2	17
12. Miscellaneous	515	827
13. Young Farmers' Clubs	—	5
Advisory		
1. Regional Planning	619	1,220
2. Farm Planning	372	200
3. Extension	1,546	2,235
4. Pegging	732	603
5. With Irrigation Engineer	100	129
6. Irrigation Layouts	79	105
7. Mechanical Units	365	518
8. Experimental Station	147	372
9. Field Days	236	292
10. Road Boards, etc.	167	48
11. Tobacco Advisory	1,721	2,520
12. Miscellaneous	815	719
TOTALS	10,315	12,824

(c) *Field Days*

The introduction of a series of "Discussion Days" carried out on several farms in each I.C.A. and dealing with a particular subject stage by stage throughout the season, were exceptionally well attended and without question helped to keep up the morale of the farmers as well as keep them abreast of developments in agriculture generally. The great improvement in yields, quality and presentation of the tobacco crop confirm the importance and value of this approach. Normal field-days were also held, the standard of which was even better than in 1957-58.

A total of 176 days were held with an attendance of 3,058, compared with 135 field-days and an attendance of 3,330 in the previous year.

(d) *Shows*

By and large all the shows in Northern Rhodesia indicated a lack of interest by the farmers. Very few entries were received in the "produce classes" and although the quality of the exhibits in the livestock sections was high, the number of entries was disappointing compared with previous years.

Commerce and Industry continue to improve the standard of their exhibits and displays.

(e) *In-service Training*

During the year officers attended courses on a wide variety of subjects.

One Irrigation Course was held at which personnel from other Departments also attended and this was found to be of great value as it broadened the scope of the discussion.

The following courses were attended by our staff:

Irrigation Course	14 Officers
Beef Course	1 Officer
Y.F.C. Course	3 Officers
Seed Production Course	1 Officer
Pig Course	3 Officers

In addition, one officer completed a full season on tobacco training; at present three officers are undergoing such training.

(f) *Teachers' Courses*

Due to the reorganization of the Education Department and the formation of the Natural Resources Board Educational Sub-Committee, the work in this field was to some extent held up. One-day outings are now being organized in all the main education centres and these events are proving very popular. Eventually it is hoped that all teachers will have participated in these Conservation field visits.

(g) *Young Farmers' Clubs*

During part of the year the Agricultural Lands Board seconded an officer to act as full time Organizer and the Movement is now being expanded at a tremendous rate. The number of Clubs, down to four in July, 1959, had risen to 12 at the end of the period covered by this report—a significant and encouraging increase. It has already reached the stage where a halt must be called to further expansion if the number of organizers is not increased. This demand is coming from both European and African areas and without doubt extra staff will have to be provided for this very important aspect of conservation education.

(h) *Provincial Administration Courses*

Assistance was given to the Natural Resources Board and Northern Rhodesia Government Ministries concerned with the running of a Natural Resources Course for members of the Provincial Administration staff. This course was well received by the members of the Provincial Administration, who were very keen to see a series of such courses organized so that all officers could attend.

12. PLANNING

(a) *Regional Planning*

The revised conditions operated during the year and the start of an all-out drive to complete Stage I (Communal) plans for all of the I.C.A.s from Livingstone to Broken Hill (with the exception of Mumbwa) by the end of 1960 has been made. This involves some fifty-nine plans or 3,573,980 acres. Of this, 22 areas have already been planned (1,221,967 acres) and 19 of these have been or are being implemented. In addition, a further ten plans covering 410,000 acres will be required in the Mkushi Area.

The details of the progress made with Regional Planning since the inception of the scheme are set out below:

PLANS COMMENCED DURING THE THREE-YEAR EXPERIMENTAL PERIOD ENDING 30.6.57

Area and Plan Name and Number	*Acreage*	*Commencement Date*	*Completion Date*
Upper Kaleya (Upper Kaleya/2)	7,728	1. 6.54	31. 5.58
Upper Kaleya (Middle Kaleya/4)	57,884	1. 6.54	31. 5.58
West Lusaka (Cheta River/1)	31,121	1. 9.54	31. 8.58
West Lusaka (Chilangola/3)	61,008	1. 9.54	31. 8.58
N. Broken Hill (N. Broken Hill/5)	110,161	1. 5.55	31.10.58
Lower Kaleya (L. Kaleya/6)	70,124	1. 8.55	31. 7.58
East Lusaka (Chalimbana/7)	100,729	1. 7.56	30. 6.59
Mazabuka (Mazabuka/8)	116,987	1.10.56	30. 9.59

TOTAL ACREAGE: 555,742

In addition to the above, 10,053 acres were planned in 1952-53 in the Upper Kaleya Pilot Scheme, bringing the total acreage to 565,795 at 30.6.57.

PLANS COMMENCED SUBSEQUENT TO 30.6.57
(UNDER OLD CONDITIONS)

Acreage and Plan Name and Number	*Acreage*	*Commencement Date*	*Completion Date*
North Kalomo (Mukwela/10)	40,491	22. 1.58	21. 1.61
S. Broken Hill (Munga River/11)	41,116	21. 4.58	20. 4.61
Zimba (Bowood East/9)	68,150	5. 8.58	4. 8.61

TOTAL ACREAGE: 149,757

PLANS APPROVED SUBSEQUENT TO 30.6.57
(UNDER NEW CONDITIONS)

Area and Plan Name and Number	*Acreage*	*Date Approved*
West Lusaka (Molendemo N.W./12)	21,264	30.10.58
South Choma (Sibanyati/24)	30,000	15. 1.59
North Lusaka (Lower Chongwe/50)	72,000	30. 5.59
Monze-Pemba (Kazangula/33)	45,000	30. 6.59
Magoye-Lower Kaleya (West Kaleya/39)	26,258	24. 6.59
Livingstone (Matesi/15)	48,376	19. 6.59
Mwomboshi (Miswa/56)	50,000	21. 8.59
Livingstone (Maramba/14)	68,746	31. 7.59
South Broken Hill (Nyama West/58)	64,132	4. 9.59

TOTAL ACREAGE: 425,776

PLANS READY FOR APPROVAL

Area and Plan Name and Number	*Acreage*
Nega Nega (Lusito/40)	29,102
East Chisamba (Malo/54)	51,537
TOTAL ACREAGE	80,639

GRAND TOTAL OF PLANNED ACREAGE: 1,221,967

PLANS IN AN ADVANCED STAGE OF PREPARATION

West Chisamba (West Wangwa/59)
North Kaloma (Kaloma/21)
Zimba (Luezi/16)
Zimba (Bowood West/17)
Monze-Pemba (Demu/31)

It will be noted that of the 22 plans approved to date, 11 have been approved during the past 12 months and work has commenced in implementing seven plans. This is a considerable improvement on previous years and with many other plans at present being worked on, this rate of progress should be maintained during the coming year. In addition, areas of the Fort Jameson district have been planned and a large amount of planning work has been done in the Mkushi area which will eventually require some ten regional plans.

A preliminary plan of a 20,000-acre estate in the Northern Province was also produced during the year.

(b) *Farm Planning*

Numerous farm plans were prepared and a large number of reports on existing holdings were supplied to the Agricultural Lands Board, the Land and Agricultural Bank and the Farmers' Debt Adjustment Board. Land Settlement Officers have now been trained in this work and this relieves the pressure to some extent.

There is a growing feeling among the credit agencies that they may, in the not too distant future, have to request farmers to produce farm plans when they apply for loans. Farm plans which include an economic report should be of great importance and if all credit organizations demanded these, there should be no need for the financial embarrassments of the 1957-58 season to occur again, provided that commodity prices remain stable. To undertake this invaluable advisory service the Department would require, on a secondment basis, the full-time services of an Agricultural Economist.

(c) *Miscellaneous Planning and Assistance*

(i) *Mkushi.* The planning of the Mkushi Settlement Scheme has been continued by the Department for the Agricultural Lands Board. In addition to advising on the subdivision of the land according to its capability and based on detailed soil surveys, roads were aligned and constructed, forty acres of land cleared on conservation lines on each of some sixty farms and dams sited and constructed. This was in addition to the normal extension advice given to the incoming tenants. This work is being continued.

(ii) *Copperbelt.* At the request of the special Commissioner for the Western Province, advice was given regarding the land-use capability of some 300,000 acres in this area.

(iii) *Abercorn.* At the request of the Agricultural Lands Board, advice was given regarding a number of holdings in the Abercorn area and a preliminary report on the irrigation potential of that particular part of Northern Rhodesia was prepared.

13. GOVERNMENT EXPERIMENTAL FARMS

The transfer of the Kambowa Experimental Farm to a new site near Kitwe has been effected and, because the development of the latter farm is still in progress, the dairy herd was transferred temporarily to Chalimbana Experimental Farm.

The Chalimbana Farm programme is under way so far as the dairy section is concerned and is arousing considerable interest among local farmers. It is intended to lay out erosion experiments there during the coming year.

At Msekera Experimental Farm, Fort Jameson, due to staff difficulties, only a few experiments were carried out and little development took place.

Normal tobacco experiments were carried out at the Mochipapa Experimental Farm, Choma, as well as trials on maize and groundnuts. The beef herd is being used for weaner production and the weaner steers transferred either to the Copperbelt or Chalimbana Experimental Farms.

Slaughter stock from some of these farms were exhibited by the Department at the Lusaka, Kitwe and Livingstone Agricultural Shows and proved a striking demonstration of the value of non-protein nitrogen supplementation.

All four farms continued to fulfil a very useful purpose in the areas served by them.

CONCLUSION

In conclusion I wish to express my sincere appreciation to all members of my staff for their loyal support and devotion to duty during the year.

For the generous co-operation and encouragement given me by the Natural Resources Boards of Southern and Northern Rhodesia, the Intensive Conservation Area Committees, the Rhodesian National Farmers' Union and the Tobacco Research Board of Rhodesia and Nyasaland I am indeed most grateful. I wish to acknowledge also with gratitude the co-operation and the help that have been given us in unstinted measure by the Department of Research and Specialist Services and other Departments, not only of this Ministry, but also of the Federal and Territorial Governments.

To the farmers themselves, whom it is my privilege to serve, I owe a debt of gratitude for everything that they have done to help me in my task. I greatly appreciate and value their friendship and goodwill.

REPORT OF THE DIRECTOR OF VETERINARY SERVICES FOR THE YEAR ENDING 30th SEPTEMBER, 1959

The Department of Veterinary Services operates with two branches, Field and Research, and the Annual Reports of the Assistant Directors in charge of these branches are given in full. It is therefore necessary only to emphasize and comment on some of the more important aspects of the information separately compiled by the forementioned officers.

Staff. On the 31st March, 1959, Mr. D. A. Lawrence the Director of Veterinary Services retired on superannuation. He had completed almost 33 years of outstanding service and was awarded the O.B.E. during this year. Until he assumed the mantle of Director of Veterinary Services he was in charge of the Research Branch where he made notable contributions to our knowledge of the tick-borne diseases, in particular the theileria group. Mr. MacKinnon and Mr. T. Lees May were appointed Director and Assistant Director Veterinary Services (Field) respectively as from the 1st April, 1959.

On the professional side the establishment was under strength. It was hoped that two young Rhodesians who were due to qualify would fill these vacancies but both turned down the offer made. The establishment of qualified laboratory assistants was also well below strength and for a short time only, the establishment of Meat Inspectors was up to strength.

It is becoming increasingly difficult to attract qualified personnel in the forementioned categories, the world market having broadened considerably with the result that competition for recruits is keen. Advertisement in the United Kingdom and South Africa, for Veterinary Surgeons, Labaratory Assistants and Meat Inspectors elicited no response. Animal Health Inspectors also present a problem of their own, in that staff can be recruited locally without much difficulty, but after having been trained at considerable expenditure of time and energy, they leave the Department to take up more remunerative and less arduous work elsewhere.

The lack of suitable housing, broken family life and police duties are mainly responsible for the failure to retain their services.

Over the years the duties, training and responsibilities of the Animal Health Inspector staff have increased out of all proportion to the original concept of the functions of such personnel and the time is fast approaching when their duties and functions must be clearly defined in relation to that of the professional staff.

Foot and Mouth Disease. The year began with an outbreak in progress in the Wankie Native District. Two other outbreaks were recorded during the year, a further one in the Wankie Native District and one in the Beitbridge Native District. Following routine procedure the virus was typed and it was found that both outbreaks at Wankie were due to S.A.T. I. and that at Beitbridge to S.A.T. I I. In all a total of 10,076 head of cattle were inoculated with S.A.T. I field virus, and 5,755 head with S.A.T. II type.

The factor common to all three outbreaks was the high game population with resultant cattle/game contact. It is obvious that this contact will be an all time one in the Wankie District in view of the game concentrations in the Wankie Game Reserve and the other two National Parks. The main danger lies in migratory game and the spilling of such into adjoining cattle areas. To reduce cattle-game contact the Federal Government agreed to provide the necessary finance to erect a game fence in the vicinity of the Wankie Game Reserve. The proposed line of this 110 miles of game fence has been cut and so far 8½ miles have been erected.

The fence will run from the north-western corner of Nyamandhlovu Special Native Area A eastward along the common boundary of the Game Reserve and the Native area to the northern beacon of the Gwaai Native Reserve, thence in a straight line to the south-eastern corner of Lugo Ranch, thence along the common boundary of the Ngamo Forest Extension and the European farms to the south-western beacon of Dett Valley Extension, thence in a north-easterly direction along the common boundary of the Game Corridor and the European farms to the Gwaai River.

In the past most outbreaks of foot and mouth disease were confined to what is known as the Victoria lowveld. The pattern of this area has changed, as anticipated, in that the steady development of the area and the work of he Tsese and Trypanosomiasis Department has reduced cattle/game contact considerably. As further development becomes more intensive game will become more restricted in movement eventually leading to an elimination of the cattle/game contact factor.

The Department does not undertake research on this disease because it would mean that active infection by passage through cattle would have to be regularly maintained and the complete isolation necessary would be difficult to achieve. However, it is now reported that progress has been made in research institutions in Britain and Israel in adapting foot and mouth disease virus to chick embryos and, in fact, vaccines have been made but so far have not been subjected to field trials. It is anticipated that during the coming year extensive field trials will be undertaken on the African continent under the auspices of C.C.T.A.

During the year the South African Government set up a Commission of Inquiry to investigate ways and means to prevent the introduction of the disease to South Africa. The Commission spent two days in Salisbury taking evidence. The Report of the findings of the Commission is eagerly awaited.

Trypanosomiasis. This disease is now regarded as one of the most important with which the Department has to deal. In the past it was the practice to withdraw cattle from infected areas and treat the infected animals with curative drugs; however, that is not the position to-day. Cattle are successfully maintained in areas inhabited by tsetse through the medium of the present, not inconsiderable, armoury of trypanocidal drugs. It is an established fact that the efficacy of trypanocidal drugs varies from country to country and even in different localities. To enable the Department to gauge the efficacy of various drugs, a small field experimental station was set up at Kariangwe. The field report indicates briefly the drugs which were under trial and the results obtained. It further indicates that a total of 930 cases of trypanosomiasis in cattle was confirmed and that 91,421 inoculations were given. This is a considerable increase on the previous years. Over the past few years there has been a steady advance of tsetse in some areas of the Colony, a state of affairs that is not peculiar to Southern Rhodesia only. It is obvious that for some years to come the Veterinary staff will be fully employed in fighting the disease until the anti-tsetse measures now in progress halt the advance, and thereafter it will be a question of either consolidation or rolling up the tsetse front to our borders.

Anti-tsetse measures are costly and a decision will soon have to be made on what use reclaimed land is to be put to; there is little advantage in reclaiming land that is of no economic value to the country. Proper land usage on the tsetse front is an essential and once the advance has been halted reclamation with planned land settlement should follow.

Rabies. Once again a reduction in the number of cases is recorded in that only 28 cases were confirmed and of this number 26 occurred in districts bordering other countries. It is pleasing to note that only one vaccinated dog developed the disease and this was only 30 days after vaccination, a period considered too short to be significant.

Since vaccination of dogs, using Flury Strain avianized vaccine, commenced in 1951 a total of 119 vaccinates developed rabies and this naturally caused considerable misgivings. However, closer attention to detail in the care of the vaccine and its injection in the correct site has eliminated to a large extent these unfortunate break throughs.

It is obvious that control measures, which to a large extent are based on vaccination of dogs and the destruction of strays, must still be pursued with vigour if we are eventually to eliminate the disease.

Unless neighbouring countries adopt equally strong measures to combat the disease, elimination will not be achieved.

Tuberculosis. By the end of the year a total of 37,981 dairy cattle was under regular tuberculin test as compared to 35,337 the previous year. This denotes that progress has certainly not been so spectacular as in previous years. In all 92 head reacted to the test. More than half the dairy cattle in the country are now under test and it is becoming increasingly obvious that the people remaining out of the scheme are reluctant to participate for fear that their financial losses will be too great should anything but a low incidence of infection be found.

This hard core of dairymen who remain out of the scheme argue that unless the present scheme is revized and a tangible financial incentive offered they will continue as heretofore.

At the same time it must be appreciated that the professional officers are, on account of pressure of other duties, fully extended to maintain the present *status quo* on regular testing.

Infertility Diseases. The three main diseases listed under this heading are contagious abortion, contagious epididymitis and vaginitis (epi-vag) and vibriosis. The first two are scheduled diseases, the third is not.

Contagious abortion to-day can be readily, economically and efficiently controlled by vaccination and could be completely eradicated by the stockowners if they would make full use of the S.19 vaccine. From time to time compulsory vaccination has been considered but administrative difficulties precluded the use of this measure. The vaccine is cheap enough, only four-pence per dose and it is distressing to relate that only 72,605 doses were sold during the year. Propaganda drives, over the years, have met with varying success.

Epi-vag on the other hand, is not so easily dealt with. In the first instance there is no test to confirm the presence of the disease, diagnosis requiring clinical examination, and secondly there is no preventive vaccine. Normally, when a diagnosis is established the herd is placed in quarantine and general control measures applied, but the difficulty arises when a decision has to be made that infection no longer exists and quarantine restrictions removed. The disease is self-limiting and eventually clears up in the female, although the bull becomes sterile and has to be disposed of. At present there are only 32 properties in quarantine. Artificial insemination and the closed herd policy have contributed materially to the progress made.

Vibriosis has now been confirmed on 55 properties. As yet, it cannot be categorically stated that infection is on the increase or whether our findings have resulted from improved diagnostic methods.

These findings have naturally caused considerable alarm amongst dairymen in particular and strong requests have been made to place the disease on the scheduled list. Prevention is easily achieved by breeding only by artificial insemination, the semen being obtained from approved centres. This is the method practised in countries where the density of the cattle population is such as to permit of adequate A.I. cover.

In this country an A.I. Service is not always available and then herd owners may be taught to carry out treatment with anti-biotics and to inseminate their cows either with semen originating from the official centre of from a non-infected bull in their herd. The condition can cause serious economic loss particularly in dairy herds but at this stage it is impossible to state what the overall loss is to the country. The disease causes temporary infertility in that a female conceives, aborts and after a few months conceives again and breeds normally thereafter.

The low calving rate has been the subject of interminable arguments and it is believed that other conditions such as nutrition and management together with mineral and vitamin deficiencies, play as great if not a greater part than disease. Limited laboratory and field investigations into this question are in hand.

Tick and Tick-borne Diseases. In general it can be stated that there has been a distinct improvement in tick control although a considerable leeway has as yet to be made up. Mortality from tick-borne diseases also showed a decline. Prewar, stockowners had to depend on arsenical preparations for tick control but nowadays the position is completely changed in that modern organic synthetic acaricides effectively influence the position. The trouble lies in the fact that these modern acaricides are not correctly used nor is dipping undertaken regularly. Too many stockowners look to the organic acaricides as being the solution of their tick problems instead of recognizing the necessity to overhaul their dipping programmes and practice regular, efficient dipping in correct dip washes.

The modern acaricides have one serious drawback in that there is no efficient dip side test to ensure that cattle are immersed in an effective tick destroying solution as is the case with arsenic. Furthermore they are expensive with the result that stockowners are inclined to economize by under-charging the dip washes which in the long run leads to inefficiency and results in ticks developing a resistance against them. At the same time tick flushes normally coincide with major crop activities with the result that dipping may be neglected in favour of other more pressing work.

A number of press articles have been issued and at all farmers' meetings advice has been freely given in an attempt to familiarize stockowners with the proper use and functions of cattle dips. Every endeavour has been made to ensure that regular inspections are carried out but only too frequently pressing demands in other spheres have disrupted inspection schedules.

In view of the armoury of efficient acaricides now on the market there is no excuse for losses from tick-borne diseases.

Agalactia in Pigs. Little has been heard of this condition *(mammary hypoplasia)* during the year. The feeding experiments conducted the previous year proved conclusively that the condition was due to the feeding of rations containing munga

which was infected with ergot. A number of cases of agalactia due to conditions such as metritis, mastitis and allied infections were recorded.

Parasitology. It is contended that one of the most important problems to successful cattle and sheep rearing is that of internal parasites. Considerable development of irrigated pastures for milk and mutton production has taken place and as time goes on, the problem of the control of internal parasites will assume greater proportions as such pastures provide ideal conditions for the perpetuation of parasites. Over the past two years, one officer has been engaged exclusively on parasitological investigations. In this connection attention is drawn to the report submitted by the Research Branch.

District Veterinary Officers, when pressure of work permits, have done valuable field work in stimulating stockowners to exercise control of parasites and in practising methods to reduce the worm burden in stock.

Considerable press publicity was given to the control and eradication of the snail vectors of bilharzia and liver fluke. This publicity was fostered by the Natural Resources Board of Southern Rhodesia.

Surveys on cattle slaughtered at the Cold Storage Commission abattoirs revealed an incidence of 69.15 per cent. infection of internal schistosomiasis and a separate survey showed a 3 per cent. incidence of visible lesions in the urinary bladders.

It is obvious that every endeavour must be made to control internal parasites in stock, the ravages of which cost the country very large sums of money annually.

The Officer-in-Charge of the parasitological section attended the Symposium and training course on *Helminthiasis* held at Nairobi during the year.

Artificial Insemination. The number of doses of semen used during the year has increased from a total of 4,201 doses in 1957-58 to 6,086 in 1958-59. This is largely accounted for by the setting up of a sub-centre at Gwelo and increased use at Bulawayo following the introduction of a scheme whereby farmers pay a flat rate of 25s. per insemination inclusive of mileage, as against the former system where mileage was charged separately, thus placing the farmer on the perimeter of the area served, at a disadvantage.

This slight increase is gratifying but it is not enough. Artificial insemination, apart from its value in disease control, is to-day recognized throughout the world as being of the greatest importance in herd improvement. Although it is difficult to exploit it to the full in this country due to our methods of husbandry and the low density of the cattle population, nevertheless it can be extremely valuable.

Vaccines. Certain vaccines are produced at the Research laboratory and others are imported and stocked. All of these are sold at cost price for the benefit of the farming community but it is clear that insufficient use is made of them.

Continual stress is placed on the need for more research into infertility and other disease problems yet the universal use of the simple and cheap preventive vaccines would go a long way to reducing the annual financial loss from disease. For example, it is considered that all heifers should be vaccinated against contagious abortion and all young bovines should be vaccinated against quarter evil but it is obvious from vaccine sales that this is not the case.

CONFERENCES

The Director represented the Federation at the 8th Annual Session of the Council of Management of the Interafrican Bureau of Epizootic Diseases, the Sixth Annual Meeting of the Interafrican Advisory Meeting for Epizootic Disease and the Symposium on Animal Helminthiasis, all of which were held at Nairobi during July.

ACKNOWLEDGEMENTS

The high standard of efficiency with which the staff carried out their duties, often under extremely trying conditions, is acknowledged with deep appreciation. Thanks are also extended to other Departments whose valued co-operation and help have been so freely given. The co-operation and help extended by the Rhodesia National Farmers' Union has also been much appreciated.

J. MacKINNON,
Director of Veterinary Services.

ANNUAL REPORT OF THE ASSISTANT DIRECTOR OF VETERINARY SERVICES (FIELD) FOR THE YEAR ENDING 30th SEPTEMBER, 1959

Assistant Director of Veterinary Services (Field): Mr. T. Lees May.

Senior District Veterinary Officers: Messrs. J. M. Williamson, H. M. Hodkin.

District Veterinary Officers: Messrs. J. Ross, A. E. Gillespie, R. W. Bryson, A. D. Hurrell, J. E. Robinson, A. Wilson.

Senior Veterinary Trypanosomiasis Officer: Mr. W. P. Boyt.

Senior Government Veterinary Officers: Messrs. J. L. M. McCulloch, W. A. Mundy, J. D. Adamson, V. A. D. Browne, R. S. Dugdale, A. J. E. Needham.

Government Veterinary Officers: Messrs. J. A. Lawrence, T. T. McNaught, I. A. Walker, J. J. Jackson, G. H. Stewart, R. L. McKenzie, A. C. Harkness, C. S. M. Kilroy, J. W. Thompson, J. T. R. Robinson, P. K. I. Mackenzie.

The Field Establishment of 29 professional officers had two vacancies at the end of the year The reservation of vacancies for young Rhodesians who were in the process of qualifying, has been fruitless in that they have gone elsewhere for better conditions and higher commencing salaries . It is becoming more difficult to recruit professional staff as the world market broadens with more attractive financial returns than the Service at present, can offer.

With the temporary resolvement of the Wankie housing problem, it was possible to fill this sub-station; and professional services by Government officials are now available at Bulawayo, Salisbury, Gwelo, Fort Victoria, Chipinga, Gwanda, Sinoia, Umtali, Plumtree, Que Que, Bindura, Enkeldoorn and Wankie.

New Appointments. Mr. P. K. I. Mackenzie on 17.10.58.

The numbers and services of private practitioners have again increased, 29 now being established in the Colony, but economics coupled with the sparse distribution of high-class stock in the, as yet, relatively undeveloped areas definitely limit their usage by cattle ranchers, and the majority of practitioners, with few exceptions, mainly concentrate their activities on small animal practice.

Animal Health Inspectors. The year opened with four and terminated with five vacancies.

New Appointments	10
Superannuation	4
Resignations	3
Transfers	1
Discharges	3

It is obvious that better financial returns will have to be made available to lay staff to compensate for the broken family life the service entails.

Enhanced use of lay staff in the control of disease and as advisory officers could be effected if less police work in the administration of the Cattle Cleansing Act was forced upon them by farmers and ranchers fulfilling conscientiously their legal responsibilities in regard to ticks and dipping. A higher class of men would also be attracted to these posts if the unpopular prosecutor relationship in duties could be minimized.

Establishment:

8 Senior Animal Health Inspectors.

70 Animal Health Inspectors.

Meat Inspection. These duties were performed at the Cold Storage Commission Abattoirs at Bulawayo Salisbury, Fort Victoria and Umtali, and at Leibigs' Factory, West Nicholson.

Staff establishment was one under strength at the end of the year, with another resignation in hand. Efforts to fill these vacancies have failed owing to higher salaries and better conditions being offered elsewhere.

Owing to the expansion of killing in these abattoirs, routing conducive to perfect inspection is being hampered by lack of space and it is obvious that a

major reorganization of abbattoir layout and meat inspection procedure must be speedily effected. Minor reorganization at Salisbury abattoir is already under way.

Establishment. 15 Meat Inspectors.

Clerical Staff. Approved establishment, fifteen, consists of three established officers, three on probation and nine temporary employees.

A permanent clerical establishment would do much to release professional officers from routine administrative duties and some expansion of clerical staff at sub-stations appears necessary.

Accommodation. Houses were completed at Inyanga and Sinoia, bringing our total to 35 houses.

Transport. All professional officers are now using their private vehicles on official duties and 85 per cent. of the lay staff operate similarly. Mileage allowances have not kept abreast of the increased costs in operating vehicles and an adjustment in such will have to be made if staff are to be expected to continue providing their own transport. The total of man-days lost through vehicle deficiencies has remained minimal and the present system is worthy of perpetuation.

General

Climate, Food and Water Supplies and the Condition of Livestock. Although rainfall was generally up to average in quantity the pattern of fall was not conducive to enhanced animal or crop production except in the lowveld in Nuanetsi and Ndanga Districts, where 40 per cent. of the rain as winter fall gave unusual winter grazing.

Early October falls were generally followed by near drought conditions. Main precipitation followed in December and January with a generalized abrupt termination of heavy rains.

Quick seeding of grass soon reduced grazing values and decline in general conditions came earlier than usual. Both browse and vlei grazing were of lower winter feed value than in the immediate past years. Over-stocking and concentration of stock on the available grazing ensured verminosis build-ups, especially in the ranching areas. A general lack of markets for surplus store stock aggravated the position.

Cattle were in lower condition in the late winter this year than they have been for a number of years.

Reports of poverty deaths during later August and September were tabled, but the figures were not unduly alarming. If earlier rains do not fall in late 1959, however, mortality may be above average.

Water supplies in general have been adequate but an overall fall in the water table has been recorded with cessation of flow in the smaller rivers, drying out of smaller dams and cessation of supplies in lowveld boreholes.

Condition in native cattle has been severely prejudiced in the lowveld by reluctance of owners to hand-pump enough water for stock from bore-holes.

In the last third of the agricultural year, a dangerous situation was created by the existence of large tracts of waterless rank grazing as potential bush fire hazards. Several extensive fires have already occurred before this year's close, especially in the highveld.

The feeding of urea and molasses with crop residues, rank veld, etc., has increased in scope.

Finishing of beef stock for a 90-day pre-slaughter period with silage, urea, etc., has increased in volume with satisfying returns and it is heartening to note Africans in reserves undertaking the feeding of steers with supplementaries under the aegis of the Cold Storage Commission.

The Dairy Industry continues to expand, despite further drop in profit, and much more attention is now being paid to infertility problems plus demand for an extended artificial insemination service with sires of greater proven potentiality.

The emergence of a Sheep Breeders' Association with the object of promoting home production of lamb and mutton in conjunction with the development of ley pastures under irrigation in tobacco rotations, etc., is recorded. Studies of sheep nutrition, parasites control, etc., have produced helpful results in the Gwelo District.

The solution of the agalactia problem has not, as yet, produced any marked swing back to increased pig production. Farmers, in general, find the profit

margin too minimal if pig feed has to be extensively bought in. The development of a swill feeding industry amongst pig owners on small holdings adjacent to the larger towns is recorded and the necessity of swill boiling is being publicized.

A revival of enthisiasm in the poultry industry is slowly fulminating, expecially as regards the broiler industry, and it is evident that extended veterinary services will be required in the near future on a preventive basis.

The overall drive for an augmented meat export industry will also call for extended advisory veterinary services and the Department is planning for such development.

Tick Life. Late heavy rains disrupting routine dipping and a mild winter devoid of heavy frosts, promoted tick survival and build-up of veld infestations. Too many farmers look to the newer organic acaricides as being the solution of their tick perpetuations instead of recognizing the necessity to overhaul their own dipping programme as the most economical and practical answer. Tick flushes generally coincide with major crop activities and only too often, dipping of cattle is abandoned in favour of agricultural demands, especially where labour is short. The species specificity of acaricides is also too often completely ignored in practice. The failure to maintain 100 per cent. production and dipping of herds, cleanliness of dipping solutions and European supervision at dipping tanks is stressed. Where the last-mentioned factors have been readjusted under veterinary supervision for a period of two to three months, many so called "tick resistance" problems have been satisfactorily resolved.

In the organic acaricide field, dirt blockage phenomenon and loss of biological efficiency has led to a marked decrease in the usage of wettable powder formulations in favour of the more efficacious emulsions and miscible oils, in dip tanks especially.

Organic phosphate preparations are being enthusiastically employed to cope with the common blue tick (*Boophilus* sp.) infestations but *Rhipicephalid* survival (brown and red tick) under this regime is underlining the wisdom of the policy of the Department in insisting on the combination of arsenic with phosphates in dipping tanks.

Toxaphene is now in general employment in lowveld ranches where its specificity in regard to bont *(Amblyomma* sp.) and bont leg *(Hyalomma* sp.) is of great economic value in reduction of disease transmitted by these ticks (e.g. Heartwater) and secondary screw-worm infestation of necrotic wounds created by such ticks.

Finally it cannot be overstressed that in regard to ticks and dipping, the mere everyday lack of application of farmers in failing to read and/or observe the directions on the labels of organic acaricides is the main contributory factor to tick survival and resistances from the employment of under-strength solutions.

Quarantine Notices.—Bulawayo 301, Salisbury 369, Fort Victoria 71, Gwelo 361, Umtali 125, Chipinga 60, Sinoia 68, Gwanda 95. Total 1,450.

Contraventions.—Cattle Cleansing Act: Bulawayo 338, Salisbury 75, Fort Victoria 77, Gwelo 216, Umtali 23, Chipinga 55, Sinoia 7, Gwanda 137. Total 928.

Animals Diseases Act: Bulawayo 206, Salisbury 36, Fort Victoria 34, Gwelo 737, Umtali 207, Chipinga 81, Sinoia 1, Gwanda 54. Total 1,356.

Livestock Inspections. The total number of livestock inspected by members of staff during the year under the Cattle Cleansing Act and the Animals Diseases Act, was 16,998,468.

SCHEDULED DISEASES

Viral and Rickettsial Diseases

Foot and Mouth Disease. The year opened with foot and mouth disease present in Wankie Native Reserve, Additional Area "A" at Sialwindi Dip, confirmed on the 26th August, 1958. Virus was typed as S.A.T. I by the Pirbright Institute. As detailed in the previous Annual Report, satisfactory cordoning was effected with the field inoculation of 9,885 head by the 18th September, 1958.

No further spreads being found and satisfactory reactions being recorded in all inoculated stock, the cordon was lifted and the quarantine area reduced on the 29th November, 1958. Final clearance of all restrictions was effected on the 16th January, 1959.

On the 30th January, 1959, the disease was diagnosed in Special Native Area "E", Beitbridge, at Chikwarakwara Dip. Immediate inspections revealed

infection at two neighbouring dip tanks Chituripasi and Chipise. Movements of Native cattle from the adjoining European Bubye farms had occurred in preparation for a sale at Chituripasi Pens on the 2nd February, 1959. Estimated age of infection was given as seven days.

Concentrations of all cattle from Chikwarakwara, Chituripasi, Chipisi and the neighbouring Shashasi dip tanks were effected along with the movements of all native cattle from the Bubye European farms to Gowa, within the cordon, for better control. A cordon was fully manned and in place by the 13th February, 1959, giving a cattle-free belt of seven to ten miles in depth on a perimeter of 28 miles around the cattle concentrations.

Inoculation of 5,755 head was completed with recovered virus on the 17th and 18th February, 1959, giving 95 to 99 per cent. reactions in all but the Chikwarakwara cattle, which showed one per cent. reaction in calves. Reinoculation of Chikwarakwara adults on the 26th February, 1959, still showed nil reaction.

Seven deaths occurred in heavy trek oxen from excessive secondary foot abscessations due to mud, septic invaders, etc.

The cordon was lifted at the end of April and Bubye native cattle were allowed to return to European farms at the end of May.

The virue was typed as S.A.T. II by Pirbright Institute.

On the 27th February, 1959, disease was again confirmed in the Wankie Native District at Railway Farm No. 50. This farm contained approximately 50 per cent. of cattle immunized in the previously mentioned Sialwindi outbreak in September, 1958. Only the remaining 50 per cent. of the 191 head showed lesions approximately eight to nine days old. This being an isolated farm with the nearest cattle approximately 15 to 20 miles distant, it was possible to isolate and herd the cattle closely with veterinary cattle guards. Inoculation with virus on the 5th March gave completely negative results. Typing by Pirbright Institute showed virus to be S.A.T. I. All cattle were slaughtered at Wankie Abattoir for local consumption 30 days after virus being injected. No spreads occurred and all restrictions were lifted on the 1st May, 1959.

The year ended with the Colony being free from foot and mouth disease.

Rabies. The following cases were confirmed during the year:

Native District	*Number of Cases*	*Date of Last Case*	*Species*
Beitbridge	—	—	—
Belingwe	1	3.12.58	dog N.V.
Bikita	—	—	—
Bindura	—	—	—
Binga	—	—	—
Bubi	—	—	—
Buhera	—	—	—
Bulalima-Mangwe	7	3.8.59	6 dogs N.V. 1 pig
Bulawayo	2	9.3.59	2 dogs N.V.
Charter	—	—	—
Chibi	—	—	—
Chilimanzi	—	—	—
Chipinga	4	6.4.59	4 dogs N.V.
Darwin	—	—	—
Gatooma	—	—	—
Gokwe	—	—	—
Goromonzi	—	—	—
Gutu	—	—	—
Gwanda	—	—	—
Gwelo	—	—	—
Hartley	—	—	—
Insiza	—	—	—
Inyanga	—	—	—
Kariba	—	—	—
Lomagundi	—	—	—
Lupane	—	—	—
Makoni	—	—	—
Marandellas	1	28.10.58	Jackal
Matobo	—	—	—
Mazoe	—	—	—
Melsetter	2	7.7.59	2 dogs N.V.
Mrewa	—	—	—
Mtoko	—	—	—
Ndanga	—	—	—
Nkai	—	—	—
Nuanetsi	—	—	—
Nyamandhlovu	3	27.2.59	3 dogs N.V.
Que Que	—	—	—
Salisbury	—	—	—
Selukwe	—	—	—
Shabani	—	—	—
Shamva	—	—	—
Sipolilo	—	—	—

Native District	*Number of Cases*	*Date of Last Case*	*Species*
Umtali	8	11.9.59	6 dogs N.V., 1 cat, 1 cow
Umzingwane	—	—	—
Urungwe	—	—	—
Victoria	—	—	—
Wankie	—	—	—
Wedza	—	—	—

Results According to Species. One hundred and seventeen specimens were examined by the Laboratory during the year.

The positive cases were as follows:

Dogs	24
Cats	1
Jackals	1
Cattle	1
Pig	1
	28

This brings the total number of positive cases since the first outbreak in 1950 to 893. The success of Colony-wide inoculation can be gauged by the record of proven cases as follows:

Year	1954	1955	1956	1957	1958	1959
Specimens submitted	474	264	181	208	165	117
Specimens positive	183	100	54	50	41	28

It is of interest to note that positives in dogs were all in unvaccinated subjects, this being the first year in which we had no breakdown in immunized dogs. Of 119 proven cases in vaccinates, only 18 occurred in the previous four years, the majority developing in the early days of the campaign. Taken together with no breakdown in 1958-59, this seems to indicate that the drive to ensure correct handling of vaccine in the field and proper placement of injection by lay staff has been fully justified.

The drop in incidence in feral animals is also worthy of note substantiating findings elsewhere that if the incidence in domestic carnivores can be controlled by block immunization then the infection in veld carnivores is self-eliminative to a large extent.

The point of note in incidence records is that 26 of the positives did occur in districts bordering other countries on the perimeter, or in adjoining districts through which migrant labour treks to the larger centres accompanied by illegally imported dogs.

The authorities in Portuguese East Africa have instituted a shooting out campaign along their Rhodesian border.

No such measures and little or no vaccination seems to be in vogue in Bechuanaland Protectorate on the western boundaries.

It is regretted to record again that many people require the goad of legal proceedings before complying with the required vaccination of dogs.

The following figures clearly illustrate the Public's inertia in this matter at a larger centre:

Dogs vaccinated week ending 2.5.59	52
Dogs vaccinated week ending 9.5.59	55

A house to house check was initiated on the 12th 13th and 14th May, together with an announcement of vaccination requirements in the daily paper, with the following results at the same centre:

Dogs vaccinated week ending 16.5.59	397
Dogs vaccinated week ending 23.5.59	143
Dogs vaccinated week ending 30.5.59	115

Private practitioners, who normally only vaccinate approximately 300 dogs per month in the same area, were called upon to vaccinate a total of 553 dogs in the above period.

Sub-centres for the inoculation of dogs in the peri-urban areas of Salisbury have been set up, and publicity given to such by distribution of notices by the secretaries of the town management boards has materially contributed to their success.

The declaration of jackals as vermin with a reward for destruction in the areas where we had found infection in such was finally gazetted as a Government measure, and has doubtless markedly aided in the decline in incidence of infection in these animals.

During the year, 592 unvaccinated dogs were destroyed and 736 persons of all races prosecuted, mainly for failing to vaccinate dogs.

A total of 159,821 dogs was vaccinated during the year, bringing the grand total of inoculation with Lederle's Flury Strain vaccine to 997,664 vaccinates since July, 1951.

Contagious Epididymitis and Vaginitis. Over the last four years unspectacular but progressive improvement has been recorded in the overall position in regard to infected premises.

Only one newly infected property was placed in quarantine in the past year, this being adjacent to a long-infected ranch which is under the same ownership. As there has been a certain amount of uncontrolled straying and movement between the two ranches, this spread was not unexpected.

Nineteen properties were released from quarantine during the year and there now remain only thirty-two properties under restrictions.

Regular inspection of these premises continues and every encouragement is given to stock owners by the early professional diagnosis of chronically infected animals and non-breeders and their expedited slaughter.

The greater use of artificial insemination in both infected and cleared herds had materially contributed to the marked decrease in infectivity and incidence.

A firmer stabilization of dairy herds, with the closed herd principle, in practice, has served usefully in control.

Lumpy Skin Disease. Mild sporadic cases have been reported from most parts of the country with little upset to cattle. Only in Matabeleland has there been widespread but mild incidence along certain main watersheds. A heavy infection was noted in bulls on the Zambezi banks in the Wankie Native District.

A flare up of the disease occurred in cattle which were undergoing quarantine in a Bechuanaland border ranch prior to importation for slaughter. Importations were of necessity cancelled for the time being.

Lumpy skin disease was noted in two heifers undergoing quarantine at Plumtree, these being imports from the Union of South Africa.

Heartwater. The widespread use of chlorinated camphene dips has materially reduced mortality from this disease. Calf mortality still occurs in the low veld but this seems to be accepted at approximately 1 per cent. loss by most ranchers. One hundred and fifty cases were confirmed on 42 premises, the majority in the lowveld, but it is evident that the bont tick is gradually extending its distribution to the highveld.

Bacterial Diseases

Anthrax. This was confirmed in the Shangani Special Native Area "A" in April, 1959, in an investigation of alleged Nagana deaths dating from two months previously. Twenty cattle, six pigs and four human deaths were recorded as having occurred. Thirteen cases of malignant carbuncle in Africans were hospitalized.

A total of 54,747 cattle, 1,896 sheep, 1,156 pigs and 1,896 donkeys were inoculated with anthrax vaccine and it was necessary to destroy the hide shed at Tshakwana, together with 630 hides.

In July, 1959, infection was confirmed at a farm in the Matobo District, four cattle deaths having occurred. Two hundred and ninety-five cattle and two pigs were inoculated with anthrax vaccine. Nine thousand, four hundred and fifty-five native cattle were inoculated in the adjoining National Park and 6,970 cattle on the surrounding European farms.

In August, 1959, eight cases were confirmed in the Que Que Reserve, Gwelo Native District. Four thousand, eight hundred and nine cattle, 143 sheep and goats, 134 donkeys and 36 pigs were immunized with anthrax vaccine.

Three thousand, three hundred and ninety-two cattle were immunized with anthrax vaccine.

The overall mortalities amounted to 42, and a total of 84,931 head was immunized with anthrax vaccine.

A. Imports tested, 1,432; reactors, nil.

B. Exports tested, 1,959; reactors, nil.

C. OLD VOLUNTARY SCHEME—

Veterinary District	*Number of Herds under test*	*Number of Cattle under test*	*Number of Reactors found during year 1958/59*
Salisbury	114	8,916	—
Bulawayo	51	4,476	4
Umtali	23	1,723	1
Gwelo	13	1,145	—
Chipinga	15	996	—
Sinoia	8	457	—
	224	17,713	5

D. COMPENSATION SCHEME—

Salisbury	104	8,563	47
Bulawayo	41	3,484	16
Umtali	33	3,709	5
Gwelo	15	1,299	1
Chipinga	11	502	—
Sinoia	7	1,121	3
Gwanda	5	500	2
Fort Victoria	4	262	1
	220	19,440	75

E. VOLUNTARY SCHEME (Beef Herds)—

Salisbury	1	600	—
Sinoia	2	64	6
Bulawayo	1	164	6
	4	828	12

The Umtali Old Eradication Schemes A and B have ceased to function and the remaining seven herds have been incorporated under the Old Voluntary Scheme tabulation.

SUMMARY:

Total number of herds under test	448
Total number of cattle under test	37,981
Total number of reactors, 1958/59	92

Progress has not been so spectacular as in past years in regards to increase in testing.

Fifty-two new herds were enrolled under the Compensation Scheme and six herds transferred from voluntary to a compensation basis.

Thirty-six herds ceased testing due to dispersals, change in farming practice, etc., though a few did withdraw due to lack of any immediate financial gain from tuberculin testing.

In all there is only a gain of nine herds in the overall workings of the year.

Taking the overall number of dairy animals as approximately 70,000, slightly more than 50 per cent. are under test.

The number of reactors has definitely fallen and an increase of "No visible lesions" on post-mortem examination of reactors has been marked, only 46 head showing visible lesions of tuberculosis.

It is obvious that consideration has now to be given to the hard core of dairy farmers who will not be attracted to tuberculin testing unless some tangible financial incentive can be offered.

The annual test on a large ranch in Matabeleland was again performed, 51,369 head being tested. Five hundred and eighty-one reactors were recorded—1.13 per cent. compared to 601 reactors in 1957-58—1.19 per cent.

First and second year steers produced a high percentage of reactors but this should definitely decrease as the main infective centre of breeding stock has now been slaughtered out.

Meat Inspection Incidence

	Bovine	*Porcine*
Cold Storage Commission, Salisbury	24	15
Cold Storage Commission, Bulawayo	10	68
Cold Storage Commission, Umtali	1	—
Cold Storage Commission, Fort Victoria	1,266	—

Of the 24 bovine carcases recorded at Salisbury, 15 were animals slaughtered as reactors from tuberculin testing. With regard to Bulawayo porcine incidence, 45 were native-owned pigs ex Southern Rhodesia and 13 in native-owned pigs ex Bechuanaland Protectorate.

With the exception of 14 head, the bovine incidence at the Cold Storage Commission, Fort Victoria, was in the liquidated reactor herd from the large ranch tested in Matabeleland.

Bovine Brucellosis (contagious abortion).

Infection was confirmed on the following premises: Bulawayo, 17; Salisbury, 19; Gwelo, 9; Fort Victoria, 4; Umtali, 5; Chipinga, 2; Sinoia, 3; Gwanda, 2; total, 61 premises.

Of 3,502 samples tested 336 were positive.

A successful propaganda drive was instituted with the active co-operation of one local Intensive Conservation Area Committee. Only five properties had previously been vaccinated in this area but by judicious propaganda by the responsible Animal Health Inspectors, over two-thirds of the heifers in the area were inoculated in two months and it is hoped to get 100 per cent. calfhood vaccination effected in the area by the end of 1959. Similar drives through other I.C.A. committees are being considered.

Seventy-two thousand, six hundred and five doses of S.19 strain vaccine were purchased in 1958-59 and it is disappointing to record the relatively small usage of such cheap and effective vaccine by the majority of cattle breeders.

Quarter Evil (clostridium chauvoei).

Outbreaks were confirmed as follows:

Veterinary District	*Outbreaks*	*Deaths*
Bulawayo	29	163
Salisbury	51	253
Gwelo	3	69
Fort Victoria	10	161
Umtali	27	117
Chipinga	3	3
Sinoia	22	109
Gwanda	10	91
	155	966

Death due to *Clostridium septique* were confirmed on one property in the Fort Victoria District. All districts report that the above figures only represent a mere fraction of the true mortality.

General apathy on the part of stock owners to effect vaccination continues and the overall picture of annual vaccination only being performed once deaths have been confirmed is again recorded. As vaccination is cheap and entails no risk to the animals, it can only be concluded that sheer indolence is the main contributory factor to these senseless losses.

It is regretted to record that incidence in Native Areas is on the increase.

Swine Erysipelas. Infection has been confirmed on three properties with few losses.

Protozoal Diseases

Trypanosomiasis. The general position on the south-eastern front was stabilized by means of increased veterinary control of the affected cattle combined with vigorous anti-tsetse measures by the Tsetse and Trypanosomiasis Control and Reclamation Department. No major spread was recorded in this area and extended use of insecticidal and bush clearing techniques seems to have temporarily stopped this threatening extension of tsetse-borne disease.

Elsewhere the advancing front of cattle settlement has been satisfactorily held with the use of trypanocidal drugs and a quiet optimism has prevailed especially in the Urungwe and Mtoko Districts.

The following table shows the number of smears taken, confirmed cases and treatment given in all infected Native Districts:

District	*Smears*	*Positives*	*Inoculations*
A. *North-Western Front*			
Binga	5,946	141	8,826
Gokwe	3,232	91	8,883
Lupane	1,931	11	4,928
B. *Zambezi Front*			
Urungwe	9,712	1	6
C. *North-Eastern Front*			
Darwin	1,513	25	701
Mtoko	905	17	1,070
Inyanga	2,046	29	9,346
D. *South-Eastern Front*			
Chipinga	7,733	465	50,858
Ndanga	3,026	91	4,294
Bikita	626	44	1,465
Nuanetsi	2,064	15	1,044
Totals ...	38,734	930	91,421

The figures show the following increase over the previous year:

Smears	*Positives*	*Inoculations*
10,400	325	21,916

The positive smears were classified as follows:

T. vivax	553
T. congolense ...	216
T. brucei ...	3
Mixed Infection	23
Untyped ...	135

Once again the actual figures of mortalities cannot be given but are accepted as very low with the increased use and range of trypanocidal drugs now available.

The disease position on the various fronts is given hereunder:

A. *North-Western Front*

Binga Native District. With the stationing of a Government Veterinary Officer at Wankie a more constant inspection and smearing was possible resulting in an increase of 115 confirmed positive cases, although the actual disease position did not materially deteriorate.

Gokwe Native District. The position remained static although infection was confirmed at two new centres north of the Kana River, viz., Kana East and Kana 1. Heretofore, block inoculation had been performed twice at an interval of two months after discovery of positive cases, and the centre carefully inspected for any reinfection.

Early in the year this policy was abandoned and only the infected kraal itself was inoculated once unless infection was widespread, when the former policy was maintained.

Antrycide D.M.S. was generally used and few, if any, deaths have been reported.

Antrycide Pro-Salt and Prothidium were used for cattle in the Mafungabusi Forest Areas.

In the face of a medium to light fly challenge, these drugs gave protection for a period of 9-10 months following a single inoculation.

Specific branding at infected centres of all stock has helped by disclosing and controlling illegal movements.

Lupane Native District. Here an improvement was recorded and it was possible to remove four previously infected dip tanks from the schedule of infected centres. No extension of infection occurred.

Nkai Native District. Regular inspection and smearing failed to reveal any cases.

B. Zambezi Front

Urungwe Native District. The position in this area seems to be promising. No positive cases were confirmed on the European farms and only one positive was recorded in native cattle on the Miami Crown Lands.

In June, 1959, the resettlement of the eastern section of the Urungwe Reserve as fenced paddocks commenced with the introduction of 172 cattle.

Regular smearing has failed to show any infection and cattle have improved in condition.

Lomagundi Native District. All smearing has proved negative and cattle are in good condition.

Sipolilo Native District. All smearing showed negative results.

Kariba Native District. One positive (*T. brucei*) confirmed in a dog at Old Rikommetjie Mission.

C. North-Eastern Front

Darwin Native District: Chiswiti Native Reserve. Smearing revealed no further infection following the confirmation at Kaitano in July, 1958. Stock remained in good condition.

Mazarabani Native Reserve. Infection was demonstrated at two centres in the north-eartern sector in October, 1958, probably being the same source as Kaitano.

Initially only infected kraals were inoculated but infection was again appearing in February, 1959, and these two centres were block inoculated with Antrycide D.M.S. in April, 1959. The southern sector remained free of infection. Game is reported to be returning in quantity, elephant, kudu and small buck being seen. Unfortunately this area is completely inaccessible during the rains.

Chimanda Native Reserve. Five cases were confirmed in May, 1959, amongst a herd at Mary Mount Mission. All cattle were inoculated with no further positive cases. The remainder of the Reserve remained free from infection.

Source of infection was puzzling as this centre was not on the perimeter of the Reserve, straying and/or illegal movement being extremely unlikely.

It was established that sheep had been imported consistently to a nearby driller's camp from an unknown source, probably from Portuguese East Africa.

Mtoko Native District: Chikwizo Native Reserve. Light recurrent infection prevails herein and block inoculation was effected in April, 1959, ten months after the previous blockage with Antrycide D.M.S.

In the interim, the only recorded cases were in 88 cattle introduced from Mtoko Native Reserve in July, 1958, indicating a good protection from Antrycide D.M.S. in an area of low fly challenge.

No deaths from Nagana have been seen in the past two years, numbers of stock having increased and good condition being maintained.

Mtoko Native Reserve. No infection was confirmed at previously infected centres and these were released from monthly inspections with the exception of Katsande and Bangawiya.

The area, Special Native Area C, to the north-east of this Reserve, was developed with fourteen major dams and one hundred miles of roads to accommodate families from the overcrowded Reserve. One hundred cattle were introduced as a test batch in July, 1959. Regular smearing has, as yet, revealed no infection and cattle are thriving.

Inyanga Native District: Inyanga North Reserve. The position remains satisfactory with only one case at Chifombe in October, 1958. Inoculation of the infected kraal stopped any further infection.

Bi-monthly block inoculations with Antrycide D.M.S. at Chimasa and Fombe continued throughout the year.

Holdenby Special Native Area. In February, 1959, the first positive case since 1956 was seen at Mandeyo. One hundred per cent. smearing showed a further 25 cases. Block inoculation with Berenil was performed to assess the fly challenge. Only one further case was seen in May, 1959.

Two positive cases were found at Ruda in July and September, 1959, the infected herds being inoculated with Antrycide D.M.S.

D. South-Eastern Front.

Chipinga Native District. Bearing in mind the improved staff position and the effect of residual spraying on the Buzi and Nyamadzi Rivers, the European farms on the border had one of the most disease-free periods for years except for the Umzelezwe River drainage area where nearly two-thirds of the positives occurred. Only 57 positives were recorded in comparison to 184 in 1957-58. The outlook for the farms in the latter area is anything but bright when considered in relation to the very serious position in the Sabi Valley.

In the Sabi Valley Native Areas, 408 positives were recorded. This can be attributed to the lifting of block inoculation coverage of the area to assess the existence of any immunity after continuous Antrycide inoculations.

Residual Antrycide protection proved of little avail in the face of the fly advancing northwards from the lower Sabi division, many kraals showing 50-100 per cent. infection. An advance of fly up the Sabi is strongly suggested, especially on the west bank. Block inoculation with Antrycide D.M.S. rapidly restored complete control of incidence, a current programme of over 14,000 inoculations every two months, being in vogue. It is of interest to note that despite this challenge and recorded disease building up since 1953-54, trypanocidal drugs have maintained cattle population, showing increases in numbers every year.

It is obvious that routine block inoculations must continue to give cover whilst the necessary fly counter-measures are gradually brought to fulmination.

Ndanga Native District. No spread was recorded but infection occurred at the majority of previously infected centres. Rupangwane, in Ndanga East Reserve, where bi-monthly block inoculation ceased in 1956, remained free from infection.

A considerable number of cases were recorded at Dendere in Sangwe Reserve and at Muteyo in Ndanga East Reserve. These areas lie to the north and south of the Mkwasini River and infection has been confined to its proximity. Block inoculation was carried out at Muteyo in September, 1959, elsewhere kraal inoculation only has controlled infection incidence.

On one European ranch, 30 positives were confirmed amongst European cattle and 26 positives amongst native-owned stock, mostly grazing towards the Cheredzi River.

Bikita Native District. Thirty cases were confirmed on one ranch and 14 positives on another ranch. Both herds had been grazing in close proximity to the Sabi River.

Nuanetsi Native District. A further 14 vivax infections were confirmed at Chibgwedziwa in Matibi No. 2 Native Reserve. Infection was confined to three kraals, the original infected centres, these cattle all watering in the Tshingwezi and Lundi Rivers at Chipinda Pools.

Only one case was confirmed at Chilonga Dip in December, 1958.

Ten per cent. smear survey of Matibi No. 2 Reserve in April, 1959, gave negative findings so the position has not deteriorated.

Drugs Trials, Kariangwe, Binga Native District

A better and fuller control of these experiments was effected by the Government Veterinary Officer, Wankie.

These cattle, in a high fly density area with a very high infection rate in dissections, were treated with various drugs during the year in order to obtain some information regarding the various protective periods of each drug.

Summary of the Results: Drug Trials I and II (Cattle imported in mid 1958).

Prothidium. At dosage level of 2 mg./kilo gave protection for 175 to 209 days. At dosage level of 3 mg./kilo gave protection for approximately 203 to 225 days and in some areas, up to 284 days.

Reinoculation at dosage of 4 mg./kilo gave disappointing results, break through of infection being seen as soon as 32 to 85 days.

It was impossible to assess whether we were dealing with drug resistance or drug failure as tablet formulation of this drug was used in the reinoculations in contrast to powder formulation in the initial trials. Tablet formulation gave glucoside formation and denigration of the trypanocidal properties, according to the manufacturers. Before all cases broke through, Berenil was used as a stopper.

Prothidium was also disappointing when used following Ethidium Bromide, Berenil and Antrycide; breakdowns occurred at 50 days approximately at a level of 4 mg./kilo. As a second injection at 2 mg./kilo, breakdowns were recorded at 46 days.

It appeared that Prothidium at dosage rates of 4 mg./kilo was too toxic and animals died three hours after inoculation in some cases.

Antrycide Pro-Salt (old formula and revised formula). These gave no significant results on a comparative basis, infection appearing at approximately 118 days after injection by both drugs.

Berenil. Generally used as a stopper and gave protection for 18 to 20 days only.

Ethidium Bromide. At both 1 mg./kilo and 2 mg./kilo gave protection at first injection for periods ranging from 60 to 31 days.

Metamidium. Five cattle were treated between 22.1.59 and 16.4.59. These five head had previously been treated with Antrycide D.M.S. and a second injection of either Antrycide D.M.S., Prothidium or Metamidium. By 15.7.59 no breakdowns had occurred and the trial was ended. A protective period of 175 days was thus proved.

Drug Trial III (included 39 new additions, March, 1959).

Group I. Controls. Naturally infected by 17.4.59. Treated with Prothidium at 3 mg./kilo on 13.5.59 and on 17.6.59. Following one breakdown on 8.8.59 these were cleansed of infection with Berenil at 35 mg/kilo on 18.8.59. Re-treated with Prothidium on 21.8.59 at 3 mg./kilo.

Group II. Prothidium. New entrants. Treated at 3 mg./kilo on 15.4.59 and first breakdown after 50 days. Group treated on 17.5.59 at same dosage rate. First break through in 58 days. Group cleansed with Berenil on 18.8.59 at 3.5 mg./kilo and subsequently treated with Prothidium on 21.8.59 at 2 mg./kilo.

Group III. Metamidium. Treated 15.4.59 at 4 mg./kilo. This group of seven head resisted infection for 146 days before the first break through.

Group IV. Antrycide Pro-Salt (R.F.). Treated at the rate of 4.5 mg./kilo of sulphate radicle and first infection seen in 50 days Group re-treated on 17.6.59 and 15.9.59—no infection seen.

Group V. Antrycide D.M.S. It was intended to give this group six injections at 40-day intervals at 4.5 mg./kilo. This had to be abandoned after three injections. After 1st injection, first infection in 26 days, after 2nd injection in 28 days, after 3rd injection in 30 days. This group was cleansed of infection with Berenil in August, 1959.

On 3.8.59 group treated with Antrycide Pro-Salt (R.F.) at 3.5 mg./kilo. No break through by the end of September, 1959.

Piroplasmosis (redwater). Confirmed cases recorded as follows: Bulawayo, 18; Salisbury, 41; Fort Victoria, 11; Gwelo, 48; Umtali, 50; Chipinga, 48; Sinoia, 18; Gwanda, 5; total, 239.

Although this total is 104 less than in 1957-58, it does not reflect the true incidence. This easily recognized condition is readily treated by owners without report, and private practitioners also deal with many undisclosed centres.

African Coast Fever. The last outbreak in Chipinga Native District in March, 1954, was cleared by slaughter in May of that year. Intensive supervision was still maintained in Chipinga and Melsetter Native Districts. No further outbreaks have occurred.

Theileriosis (Gonderia lawrencei). Outbreaks were confirmed as follows:

	Centres	*Deaths*
Bulawayo	5	90
Salisbury	19	130
Fort Victoria	2	3
Gwelo	1	6
Umtali	1	3
Sinoia	5	42
	33	274

The policy of the full control of *Rhipicephalid* tick flushes, with the avoidance of the ensuing toxicosis, has been implemented on all known Theileriosis centres and their contacts. As soon as compulsory dipping falls due on November 1st special visits are paid to such centres in order to ensure early and efficient dipping to prevent any Rhipicephalid build up. Thereafter particular attention is paid to ensuring the continuance of such tick-free conditions throughout the tick flush season.

This has certainly decreased the mortalities as the following figures demonstrate:

Year	*Outbreaks*	*Deaths*
1956/57	34	601
1957/58	22	437
1958/59	33	274

Fungal Diseases. Cutaneous streptothricosis (Senkobo skin disease). Outbreaks continue in the native areas of Lupane and Gokwe Districts. Further infection was seen on a farm in the Wankie Native District with eight deaths.

Experiments with various drugs in the treatment of this disease are proceeding but the indications are that some benefit is obtained only after prolonged treatment with Tinevet, Teoquil, etc.

Diseases Due to Mites. Demodectic Mange. Fairly widespread incidence was recorded in the Lupane, Nkai and Gokwe Native Districts and this condition is becoming of economic significance.

Drug trials are in hand with delta isomer, Alodan, etc., but no conclusions can as yet be drawn.

Sarcoptic Mange. One outbreak, Sinoia Native District, pigs; four outbreaks, Gwelo Native District, pigs.

Sheep Scab. One outbreak, Sinoia Native District, goats, 18 deaths; one outbreak, Umtali Native District, sheep; one outbreak, Victoria Native District, sheep.

Rapidly controlled by benzene hexachloride dipping. Only very rare incidence is now seen of sheep scab and sarcoptic mange in the one time chronic centre in the Sabi Valley, Chipinga Native District.

SCHEDULED DISEASES OF POULTRY

Viral Diseases

Fowl Pox. Outbreaks still continue but mostly in small backyard flocks where vaccination has not been effected. Mortality is usually low.

Newcastle Disease. No incidence in 1958-59.

Bacterial and Spirochaetal Diseases

Fowl Cholera. Only two outbreaks confirmed necessitating slaughter of 669 fowls.

Fowl Typhoid. A total of 16 outbreaks was confirmed, the disease being eliminated by means of blood plate tests, slaughter of reactors and disinfection of premises. Two clear tests must be secured before clearance is given. During the control of these outbreaks a total of 4,352 birds was tested.

Bacillary White Diarrhoea: No outbreaks occurred. One hundred and seventy-one premises were tested, a total of 104,433 birds. This shows a decrease of approximately 20,000 birds on test compared to last year.

Spirochaetosis. Two small outbreaks were dealt with in Bulawayo Native District.

Protozoal Diseases

Coccidiosis. Despite coccidiostatic drugs being freely available, widespread incidence in the four to six week old class is again recorded, mostly due to faulty management. It is well known and treated by owners but causes considerable loss every year.

Infectious Synovitis. This disease was confirmed for the first time in Rhodesia in September, 1959, on one property in Que Que Native District and was traced to recent importations.

Ephemeral Fever. This condition became noticeable as early as October, 1958, and incidence continued until April, 1959. By January and February, 1959, it had assumed epidemic proportions in certain areas and was of a particularly virulent nature. Cases were characterized by prolonged decubitus and marked oedema of limbs. In prolonged decubitus cases mortality was seen with internal abscessation as a marked post-mortem finding.

In Gwelo Native District, dairy cattle were particularly affected and many cases were seen in very young calves.

Ophthalmia. Incidence was similar to 1957-58. Exotic breeds, especially weaners, particularly affected. General concensus of opinion is expressed that vitamin A supplementary injections have decreased incidence in ranch stock in the Midlands and Matabeleland.

Vibrio Foetus. A large number of mucus samples were submitted from suspected herds. Fifty-four properties were found to be infected—Salisbury, 36; Bulawayo, 10; Gwelo, 4; Umtali, 4.

Improved laboratory facilities have materially assisted in diagnosis and shown that the infection is fairly widespread.

In dairy herds free service in uterine irrigation, etc. is given in acute outbreaks until the usual herd recovery with improved breeding becomes apparent.

Paratyphoid. The disease took its customary toll of kraaled ranch calves, especially during the rains. Calfhood and to some extent maternal vaccination is practiced in dairy herds but little interest in a double dose calf vaccine is shown by ranchers, mostly due to extra handling and labour problems.

Coccidiosis in Cattle. Widespread incidence is reported from the Chipinga Veterinary District amongst young and adult stock. Generally, outbreaks are successfully controlled although economics of treatment of sub-acute adult cases are a problem. Zoaquin has proved of value in persistent infections. Incidence to a lesser extent, was confirmed in the Midlands and Matabeleland but many calf deaths occur on ranches before the condition is recognized. Cases were also confirmed in sheep in the Gwelo District.

Anaplasmosis. Cases have been confirmed as follows: Bulawayo, 74; Salisbury, 54; Fort Victoria, 40; Gwelo, 146; Umtali, 28; Chipinga, 40; Sinoia, 18; Gwanda, 3; total, 403.

This incidence (c.f. 1957-58, 251) only represents a fraction of total cases and general opinion is that this disease is on the increase, probably due to misuse and abuse of organic dipping preparations. Many farmers recognize the disease and successfully treat infected animals with terramycin.

Myiasis. Very low incidence. Greater use of the organic acaricides, especially chlorinated camphenes, has largely contributed to control.

Horsesickness. Few cases reported although private practitioners must have dealt with a fair number.

Verminosis. Once again propaganda in this matter continued during the year. Numerous lectures and demonstrations were given by staff to stock owners at field-days, etc., to impress the advantages of regular dosing programmes in control.

Stock owners are generally becoming more conscious of the ravages of verminosis but the labour cost in dosing seems to be a major drawback, especially in ranching areas.

The National Bilharzia and Liver Fluke Eradication Campaign has afforded the Department the opportunity to draw attention to the subject of internal parasite control in general.

Much useful work was done in the Gwelo District on studies of worm rise and falls in sheep flocks, compared to cattle infestations. The losses in sheep are much more obvious with accelerated emaciation and heavy mortality, than are seen in cattle.

The use of one in ten phenothiazine lick in sheep has greatly reduced the number of regular dosings required, but unfortunately the cost precludes general usage.

Aphosphorosis. Wider recognition of this condition in winter has been reported. Symptoms have varied from the typical "stiff sickness" to infertility, abortions and retained placentae.

Phosphorus supplementation—mineral lick or water addition—is increasing in practice.

Enterotoxaemia. With the growing number of sheep in the country and feeding for mutton and lamb, this condition is becoming more prevalent. Vaccination has given good protection.

Bowel Oedema in Pigs. Has occurred on several properties in Salisbury and Umtali Districts. Mortality on one property was 60 pigs.

Poisoning

Arsenic. Deaths from arsenical poisoning are reported as follows: Bulawayo, 151; Salisbury, 159; Fort Victoria, 13; Gwelo, 169; Umtali, 98; Chipinga, 22; Sinoia, 89; Gwanda, 11; total, 782.

It is regrettable that arsenical dipping, the sheet anchor of our tick control, should continue to be so heavily prejudiced by sheer carelessness and inefficiency on the part of the stock owners themselves in the handling and control of arsenical dip.

Hydrocyanic Acid. Five deaths.

Zinc. One death.

B.H.C., D.D.T. and Toxaphene. Ninety-eight recorded deaths.

A further uncertain number of deaths from D.D.T. poisoning was also recorded in Bulawayo District. Most of these deaths were due to farmers not reading directions clearly given on drum labels.

Organophosphorous Compounds. Six deaths, eight abortions and much loss of milk yield was seen in a Salisbury dairy herd where parathion had been mixed accidently in a phosphate spray preparation.

Cyclodeines. Aldrin was responsible for 17 deaths in poultry on one property and reports of deaths of pigs, poultry and dogs followed the spraying of huts as an anti-malarial measure, in the Matobo Native District.

Fertilizers

Nitrates. Fifty-three deaths.

Superphosphates. Three deaths.

Urea Supplementation. Thirty-nine deaths.

Veld Poisoning. Two hundred and forty-six deaths recorded.

In the North, *Lantana camara* poisoning has assumed threatening proportions (102 deaths) and in the South, *Dichapetalum cymosum* (M'kauzaane) is becoming a major threat to much grazing in ranches especially in the Nyamandhlovu and Bubi areas. Other plants incriminated included *Senecio* (Eastern Districts), *Crotalaria, Sarcostemma, Urginea, Melia, Pteridium* and *Cestrum* sp.

Anthelmintics. One hundred and twenty-six deaths (particularly in sheep) followed dosing with hexachloroethane and tetrachlorethylene. The failure of farmers to test-dose members of badly infested flocks and herds before general dosing was largely responsible for these failures.

ARTIFICIAL INSEMINATION

Three centres are now being operated, viz., Salisbury, Bulawayo and Gwelo. Only Bulawayo and Gwelo are dealt with herein.

The number of inseminations at Gwelo increased considerably in the latter part of the year. Further expansion in this area is unlikely as there is a stud breeder of high quality who sells his bulls at a reasonable price.

At Bulawayo, the adoption of a flat rate of 25s. per insemination, with no mileage charge within a 30-mile radius, gave an increased usage of over 100 per cent.

Inseminations Performed. Gwelo, 635; Bulawayo, 1,717.

It is obvious that this service could be greatly expanded if bulls of a much higher potentiality were available or imported deep freeze semen could replace the present bull centre.

A demand for a high-class Jersey semen in Gwelo and Bulawayo exists and material expansion could be secured if such was readily available.

The interest of dairymen in artificial insemination as a livestock improvement measure as well as a disease control factor is markedly quickening and must be carefully fostered.

In conclusion, my thanks are expressed to the staff of both Federal and Territorial Departments with whom the Department of Veterinary Services has worked closely during the year.

I also wish to express my appreciation to all members of my staff, who have so consistently given of their best during the past year.

STOCK SLAUGHTER FIGURES

	Cattle	*Pigs*	*Sheep and Goats*
Bulawayo C.S.C.	86,746	20,971	2,068
Salisbury C.S.C.	97,158	54,408	8,992
Fort Victoria C.S.C.	49,829	6,637	986
Umtali C.S.C.	11,352	14,058	2,442
	245,085	96,074	14,488

The corresponding figures for last year were—Cattle 185,324, Pigs 89,052, Sheep and Goats 11,376

CARCASE CONDEMNATIONS

	Cattle	*Pigs*	*Sheep and Goats*
Bulawayo C.S.C.	774½	438	6
Salisbury C.S.C.	664	114	35
Fort Victoria C.S.C.	1,236½	46	1
Umtali C.S.C.	113¼	26	17
	2788¼	624	59

MAIN REASONS FOR CONDEMNATION

	Cattle	*Pigs*	*Sheep and Goats*
Emaciation and Oedema	1,237	13	32
"Measles" (*Cysticercus bovis* and *C. cellulosae*)	538	504	—
Tuberculosis	302½	9	—
Pleurisy and Peritonitis	190½	3	—
Sarcocysts	126	27	—
Bruising	107	6¼	3
Pyaemia	41¼	21	2

Bovine carcases—minor measles incidence—detained for freezing—1,423 carcases.

The vast majority of porcine carcases condemned for "measles" occurred at Bulawayo abattoir where numerous pigs from Native Reserves are slaughtered. This indicates the high incidence of tape-worm amongst Africans in these areas.

CATTLE CENSUS AND DIPPING TANKS

	European	Native	Total	Dip Tanks	Spray Races
Bulawayo	391,616	473,817	865,433	1,021	73
Salisbury	332,315	330,863	663,178	1,362	342
Fort Victoria	183,875	432,413	616,288	649	36
Gwelo	316,730	260,928	577,658	842	28
Umtali	73,151	153,401	226,552	476	69
Chipinga	51,895	49,608	101,503	245	19
Sinoia	103,577	56,985	160,562	323	78
Gwanda	135,250	334,051	469,301	326	10
TOTAL	1,588,409	2,092,066	3,680,475	5,244	655

IMPORTATIONS

	South Africa	Bechuanaland Protectorate	Northern Rhodesia	United Kingdom	Total
Bulls	185	16	2	—	203
Cows	216	79	13	—	308
Heifers	936	—	—	—	936
Calves	63	12	—	—	75
Mares	178	—	—	—	178
Stallions	52	—	—	1	53
Geldings	495	2	2	—	499
Mules	111	—	—	—	111
Pigs	12	—	—	—	12
Sheep	1,193	—	—	—	1,193
Slaughter Stock—					
Bulls	—	6	—	—	6
Cows	—	35	—	—	35
Oxen	—	2,425	—	—	2,425
Mixed	—	6,570	—	—	6,570
Pigs	—	2,786	2,575	—	5,361
Sheep	2,844	2,340	—	—	5,184
Goats	—	341	—	—	341
				TOTAL	23,490

Bovine: 10,558 Equine: 841 Porcine: 5,373 Ovine: 6,377 Caprine: 341

EXPORTATIONS

	Northern Rhodesia	Bechuanaland Protectorate	Portuguese East Africa	Belgian Congo	Nyasaland	South Africa	Israel	Total
Bulls	107	2	18	9	6	—	6	148
Cows	182	13	139	—	—	—	—	334
Heifers	251	—	281	105	1	—	120	758
Calves	23	2	9	—	2	—	—	36
Oxen	173	—	23	—	—	—	—	196
Mixed	81	*364	—	—	—	—	—	445
Mares	12	3	1	—	—	10	—	26
Stallions	—	—	2	—	—	—	—	2
Geldings	54	8	5	—	—	13	—	80
Mules	—	4	—	—	—	—	—	4
Donkeys	202	—	—	—	—	—	—	202
Pigs	159	3	87	—	—	2	—	251
Sheep	101	*359	—	—	1	23	—	484
Goats	42	—	—	1	—	—	—	43
Slaughter Stock—								
Mixed cattle	8,157	—	—	—	—	—	—	8,157
Sheep	2,043	—	—	—	—	—	—	2,043
Goats	624	—	—	—	—	—	—	624
Pigs	4,103	—	—	—	—	—	—	4,103
Donkeys	17	—	—	—	—	50	—	67
						TOTAL		18,003

*The 364 cattle and 359 sheep exported to Bechuanaland Protectorate were the property of repatriated Africans.

Bovine: 10,074 Equine: 381 Porcine: 4,354 Ovine: 2,527 Caprine: 667

REPORT OF THE ASSISTANT DIRECTOR OF VETERINARY SERVICES (RESEARCH) FOR THE YEAR ENDING 30th SEPTEMBER, 1959

Staff

Assistant Director of Veterinary Services (Research): Mr. G. J. Christie.

Chief Veterinary Research Officer: Mr. D. K. Shone.

Senior Veterinary Research Officer: Mr. R. M. Roberts.

Veterinary Research Officers: Mr. J. B. Condy, Mr. J. R. Philip.

Chief Laboratory Assistant: Mr. G. E. Wells.

Laboratory Assistants: Mr. D. B. Vickers, Mr. D. M. Scott (temporary).

Lay Inseminators: Mr. R. W. A. Price, Mr. J. S. Ward, Mr. O. Veldman, Mr. J. M. Selby (on secondment from Field Staff).

Station Superintendent: Mr. F. J. A. Waller.

Stockman (Gwebi Research Station): Mr. A. Craddock.

Clerical Officer: Mr. P. H. R. Humphries.

Clerical Officer (typist): Mrs. E. H. Harrison.

Clerical Officer: Miss W. E. Filsell.

Although the technical vacancies were widely advertised this was not successful in attracting trained personel and all three vacant technical posts were filled in temporary capacities.

The Laboratory was fortunate in securing the services of Mrs. B. J. Currell, A.I.M.L.T., who occupied one of these posts from November, 1958, to August, 1959.

It has now been decided to fill two of these posts with permanent personnel, irrespective of their technical standing. This will mean that the professional officer will have to devote a considerable portion of his time to training these new technical officers

An expansion of the professional staff will be necessary before it will be possible to undertake histo-pathological examinations or any work of a biochemical nature, both subjects of extreme importance in present day veterinary science.

The help extended to the Laboratory by the Director of Veterinary Services, Onderstepoort, on all occasions when it has been sought, is greatly appreciated.

ROUTINE SERVICES

The increasing use being made of the diagnostic facilities of the Laboratory by members of the Field Staff, private practitioners and farmers is an encouraging sign, proving as it does, that this service is a useful adjunct to disease control in general. This general increase is also reflected in the poultry work.

The limiting factor here, however, is the lack of trained technical staff and this means that a great deal of the routine work has to be dealt with by a professional officer leaving him far too little time for more complex investigations and research. Many of the the disease problems presented require further study in the field, collection of suitable specimens, etc., but this is impossible because of pressure of routine work at the Laboratory. It is essential that the professional officer, in order to express the full scope of his potential, has the background support of trained technical staff.

The Laboratory is handicapped by the lack of adequate buildings for small animal colonies—an essential for any laboratory where examinations involving biological tests have to be undertaken.

In the past the adaption of existing buildings has sufficed, but it is now obvious because of increased requirements that the problem can only be solved by the erection of specifically designed, easy to supervise, accommodation which will facilitate the production of adequate healthy mice and guinea pigs.

The issue of specially constructed easily recognizable containers complete with sterile bottles, etc., to the District Offices has greatly facilitated the submission of suitable specimens from the field.

A larger and more comprehensive range of selective media for bacteriological work has been introduced this year to facilitate the isolation of salmonella, mycobacteria and clostridia species.

Diagnostic Services.

A total of 11,054 specimens for diagnosis was dealt with during the year.

Smear Examination. A total of 321 smears was examined and the following diagnoses made:

Piroplasmosis	42
Anaplasmosis	105
Trypanosomiasis	151
Anthrax	2

While the majority of these smears were examined in confirmation of field diagnosis, the considerable increase of piroplasmosis and anaplasmosis diagnosis were recorded while checking smears submitted from a ranch where vaccine had been used.

Serological Tests. A total of 4,069 agglutination tests for contagious abortion was undertaken, showing 225 positive results. Three thousand, four hundred and forty-nine tampon agglutination tests were undertaken resulting in 265 positives, while 36 milk rings tests gave eight positives.

A total of 3,449 tampon tests was carried out for *vibrio foetus* diagnosis, resulting in 424 positive cases which meant the diagnosis of disease in 55 herds—this test is basically a herd test.

Other Diagnostic Methods

Rabies ... ... 28 cases

One hundred and seventeen specimens were submitted, 22 being histologically positive and six biologically positive.

Biological examinations undertaken in all cases of histological negatives, showed that 24 dogs, one jackal, one cow, one cat and one pig were affected. Analysis of the 24 dog cases shows that one case was vaccinated approximately one month before onset of symptoms—this period is considered too short to be significant.

Tuberculosis ... ... 12 cases

Eighty-one specimens were submitted for examination, seven proved positive on microscopic examination and five on biological examination.

Quarter Evil ... ... 20 cases

Malignant Oedema ... ... 2 cases

Diagnosis of these two conditions is based opon isolation of organisms, guineas pig post mortems and guinea pig passive immunity tests. Neither case of malignant oedema was associated with an outbreak but were merely sporadic cases—this is in agreement with the previous suggestion that this condition is of doubtful economic importance.

Calf Paratyphoid ... ... 6 cases

Mastitis ... ... 350 cases

There was a considerable increase in the number of samples tested this year, and several problem herds were dealt with by the Department at the request of practising veterinary surgeons. It is quite evident that the personal attention paid to such herds by a Veterinary Research Officer was a very great factor in the elimination of the condition, but the number of herds which can be dealt with is limited by the amount of technical help. Chronic streptococcal mastitis is definitely the major problem in a large number of dairy herds round Salisbury, and the poor milking techniques in use and the lack of adequate supervision during milking is responsible for much financial loss in these herds.

Poisoning ... ... 129 cases

Of the 129 positive poisoning cases, 128 were due to arsenic and 1 was due to lead.

The regularity with which arsenic heads the list of poisoning cases is evidence of the importance of this condition and the large majority of these fatalities are associated with careless handling of dips.

To date we have only recorded one outbreak of poisoning due to the use of organic phosphatic dips and in no way was the owner of the cattle to blame—the fault lay with the makers of the product.

Corynebacterium Infections ... ... 12 cases

While in one case, these infections were associated with an outbreak of pneumonia in calves, the remainder were merely sporadic pneumonia and lymph gland infections.

Enterotoxaemia ... ... 10 cases

There has been a marked increase in the incidence of this condition amongst sheep flocks in the Salisbury District. Diagnosis in most cases is by the demonstration of toxins and by means of specific serum neutralization tests, the toxins being typed as due to *Clostridium welchii* type D. A general warning has been issued through the medium of the agricultural Press with the suggestion that sheep owners, to avoid loss, should undertake preventive vaccination. At least two commercial firms retail this type of vaccine in the country and the control resulting from vaccination is excellent.

Virus Pneumonia of Pigs ... ... 2 cases

These confirmations were made possible by the examination of material by the Director of Veterinary Services, Onderstepoort.

It is probable that this condition is relatively widespread in the country, but is not showing its true economic colours because (1) our climate and methods of pig keeping exercise a certain amount of control over it and (2) our present position, where production balances consumption, ensures a high level of pig husbandry. Should there be, for any reason, an upsurge in the production of pigs it is anticipated that there will be a corresponding increase in the incidence of this disease.

Post Mortems ... ... 113 cases

During the year post mortem examinations were undertaken on nine bovines, 29 sheep, 32 pigs, 41 rabbits, one dog and one cat—these were all made for the purpose of diagnosis.

Tuberculin Tests ... ... 19 cases

These tests were undertaken on animals imported from the United Kingdom and the United States of America—no reactions were found. The single comparative is the test used, the tuberculins being obtained from Weybridge in the United Kingdom.

Poultry Diseases Diagnosis Section

A total of 1,291 post mortem examinations was undertaken during the year.

The following diagnoses were made:

SCHEDULED DISEASES

Fowl Typhoid	48
Fowl Cholera	2
Coccidiosis	282
Roup	27
Fowl Pox	13

NON-SCHEDULED DISEASES

Visceral Lymphomatosis	198
Neurolymphomatosis	20
Histomoniasis (chickens only)	48
Pullet Disease (visceral gout)	12
Non-specific Bacterial Conditions	133
Chronic Respiratory Disease	66
Infectious Synovitis	16
Ectoparasites	10
Helminthiasis	23
Incorrect Management (chilling, etc.)	152

These figures naturally, give no indication of the actual losses involved, as in most cases only two or three birds are submitted in the case of an outbreak which may involve several hundred. A great deal of time is taken up with giving advice on control and therapeutic measures.

Coccidiosis. The losses, particularly from *E. tenella* infections, are extremely high, though acute haemorrhagic intestinal forms are also common. A noticeable factor has been the increasing use of coccidiostatic drugs incorporated by manufacturers in their feeds. Unfortunately many farmers tend to rely greatly on these

remedies and fail to pay sufficient attention to the more important aspects of management and hygiene in the control of this disease. The result is that coccidiosis becomes endemic in the flock with periodic flare-ups of heavy mortality which cannot be controlled without the use of different and more expensive drugs.

Fowl Pox. Judging from reports received, a number of serious outbreaks of fowl pox occurred particularly during February and March. In all cases these were in unvaccinated flocks and no substantiated reports were received of a breakdown in immunity to the vaccine.

Fowl Typhoid. Several outbreaks occurred, mainly in June and July. Mortality is rapidly controlled by the the use of Nitrofurazone, but this must be followed up by the use of the plate B.W.D. test to eliminate carriers together with very strict hygienic precautions. *S. Pullorum* disease was again absent this year though a very strict watch was kept for it and all fowl typhoid reactors confirmed by bacteriological isolation and sugar fermentation tests.

Lymphomatosis. The vast majority of breeders in this country pay little attention to attempting to reduce the ever-increasing losses from cancer. A sound breeding policy based on the "closed-flock" principle with careful attention to records and properly conducted post mortems can reduce the losses from cancer (over a period of several years) to almost negligible proportions. Unfortunately, there is insufficient incentive at present to induce breeders to undertake the additional work that this necessarily involves, with the result that the various forms of lymphomatosis are increasing to alarming proportions. Until such time as a random sample laying test is introduced (as in the United States) or a consumer resistance arises among chick purchasers, there is practically nothing that can be done about this problem.

Chronic Respiratory Disease. This disease has inevitably made its appearance with the rapid growth of the broiler industry. While C.R.D. has been suspected as being present for some time, it has been possible to confirm its presence in several flocks this year, using the p.p.l.o. antigen imported from America. The majority of farmers are totally unaware of the devasting nature of this disease particularly in young broiler stock kept under intensive conditions. Insufficient testing has been performed to enable us to judge how widespread the disease is in this country, but two facts have already emerged:

(1) Several broiler farmers have been very hard hit and have either had to replace their entire stock at considerable loss or go out of business altogether.

(2) It is becoming almost impossible to advise potential buyers where to obtain C.R.D. free stock.

Infectious Synovitis. A condition was diagnosed in a batch of six-week old birds imported as day-olds from the Union which conformed exactly to the disease known as infectious synovitis. The birds showed typical symptoms of leg weakness, swollen synovial sheaths of the leg and wing tendons, loss of weight, light splenomegaly and breast blisters.

The disease has not been previously described from this country. It is hoped to control the spread of the outbreak by slaughter of the infected and in-contact birds.

PREVENTIVE AND CURATIVE SERVICES

Vaccines and Remedies

Vaccination is one of the most effective methods of disease control. In a country such as ours where the veterinary cover is very widely spread indeed, its importance cannot be overstressed. Often the farmer has to rely on a telephone diagnosis and finds himself involved in an extensive programme of the use of antibiotics to add to his already expensive losses.

The Government, by producing or importing those very necessary vaccines is assisting in cutting down farming costs. Essential vaccines are not controlled by a limited sale to specified groups as in some countries. The Department gives every encouragement and advice to farmers who wish to vaccinate their stock, realizing that it is more economic to prevent disease than to cure it.

Quarter Evil Vaccine	643,400 doses

This figure means that nearly 164,000 more doses of this vaccine were issued this year when compared with last years figures—this is a very considerable in-

crease and would appear to show that the efficacy and the benefits of this vaccine are being recognized.

Quarter Evil/Malignant Oedema Vaccine ... 38,470 doses

The use of this vaccine is only advised where there have been breakdowns in quarter evil vaccinated animals.

This Laboratory has not succeeded in relating such breakdowns to an outbreak of malignant oedema, but merely to the occurrence of sporadic cases. Although many countries in Africa issue this vaccine combined with quarter evil, it is by no means certain that it is essential. The organism has rather an ubiquitous distribution and its recovery from a carcase, especially where the animal has been dead some time, may not be of diagnostic importance.

Horsesickness Vaccine ... ... 4,654 doses

The use of this vaccine remains remarkably constant over the last few years. With the exception of a few ranches where horses are used in cattle work the majority of the horse population are riding-horses or race-horses.

Redwater and Gallsickness Vaccine ... ... 7,295 doses

Gallsickness Vaccine ... ... 16,818 doses

The use of gallsickness vaccine on several of the large ranches now appears to have become an established custom and, since the strain is *Anaplasma Centrale*, its use on young animals at weaning time does not create any handling difficulties as there is no necessity to smear the animals subsequently.

The major portion of this vaccine is issued over two, months, namely, April and May.

Contagious Abortion Vaccine ... ... 72,605 doses

The use of this vaccine is considered essential wherever cattle breeding is undertaken and although no opportunity is lost in making this known, there are still quite a number of otherwise progressive farmers who do not use it. One vaccination between six and ten months is known to give adequate protection and, at a cost of only fourpence a dose, it is the cheapest method of controlling one of the known causes of infertility.

Immunization and Quarantining of Animals. The number of animals passing through the quarantine stables continues to drop—this year's total was 35 cattle and 7 pigs. Countries of origin: United Kingdom, 18 cattle and 6 pigs; Union of South Africa, 13 cattle; Sweden, 1 pig; Southern Rhodesia 4 cattle. Breeds: 7 Jersey, 7 Shorthorn, 6 Friesland, 5 Hereford, 4 Aberdeen Angus, 4 Ayrshire and 2 Sussex.

Only 27 of the 35 cattle were vaccinated in the stables against redwater and gallsickness. Where very young stock is brought in by air—and this is becoming quite a favoured method of transport—the animals are usually quarantined only and vaccinated later, on the owner's premises.

Anthrax Vaccine ... ... 169,210 doses

The majority of the above vaccine was again used on outbreaks in native reserves, mostly in revaccination following past outbreaks.

Calf Paratyphoid Vaccine ... ... 5,984 doses

Adult Paratyphoid Vaccine ... ... 355 doses

A number of cases of shock were reported following the use of our calf paratyphoid vaccine. Since the number of doses is small and the system of production, which would have to be instituted to eradicate this shock factor is so complicated and not worth applying to such small batches such as are being produced at present, it was decided to import the vaccine from Onderstepoort, until such time as demand justifies the improved method of production.

The adult paratyphoid vaccine is already being imported from Onderstepoort.

Blue Tongue Vaccine ... ... 6,100 doses

The increased interest in sheep production is being reflected in the rising use of this vaccine. Although the vaccine is not used in flocks of pure Blackhead Persians a number of owners are using other breeds for crossing with the Persian with a resultant increase in vaccine use.

Enterotoxaemia Vaccine ... ... 2,100 doses

It would seem that the drop in the use of this vaccine is responsible for the increased number of outbreaks of enterotoxaemia, combined with better feeding of sheep in an endeavour to produce young fat lambs.

In view of the present rising curve of outbreaks, all sheep owners are advised to consider the use of this vaccine.

Rift Valley Fever Vaccine ... ... 650 doses

The use of this vaccine has dropped to approximately 20 per cent. of last year's figure. It is interesting that during the examination of aborted foetuses in the 1958 and 1959 Rift Valley fever seasons, i.e., February to May, on no occasion was the virus of either Rift Valley fever or Wesselsbron isolated—this is in accordance with the cyclic occurrence of these conditions.

Fowl Pox Vaccine ... ... 377,500 doses

Most poultry keepers are aware of the benefits of this vaccine and this is evidenced in the steady sales of vaccine.

Remedies

Nodular Worm Remedy ... ... 41 tins

This is the only remedy remaining in stock as it is now easy for the farmer to obtain such necessities from chemists or commercial firms in the country.

ARTIFICIAL INSEMINATION

Doses of Semen Used

	1958/59	1957/58	1956/57
Salisbury Inseminator	1,869	1,831	2,318
Bulawayo Inseminator	1,717	817 Jan.–Sept., 1958	531
Gwelo Inseminator	635	347	—
Supplied to Farmers, Salisbury	1,773	1,066	641
Supplied to Farmers, Bulawayo	17	40	—
Supplied to Farmers, Gwelo	1	14	—
Veterinary Department Animals	74	86	56
TOTALS	6,086	4,201	3,546
Total doses Friesland Semen	5,368	3,740	3,019
Total doses Jersey Semen	718	461	527
TOTALS	6,086	4,201	3,546

Milage Covered by Inseminators

Salisbury	31,921	25,318	31,066
Bulawayo	28,708	14,147	10,977
Gwelo	6,319	4,316	—
TOTALS	66,948	43,781	42,043

Revenue, 1958-59

Salisbury	£	s.	d.
Semen used by Inseminator — 1,010 doses at 15s.	757	10	0
Semen used by Inseminator — 699 doses at 25s.	873	15	0
Nominated Service — 52 doses at 20s.	52	0	0
Nominated Service — 35 doses at 30s.	52	10	0
Semen used by Farmers — 1,773 doses at 15s.	1,329	15	0
Mileage — 14,755 miles at 1s. per mile	738	15	0
Railage	41	1	8
Journeys for Inseminations — 3 at 25s.	3	15	0
Bulawayo			
Semen used by Inseminator — 383 doses at 15s.	287	5	0
Semen used by Inseminator — 1,334 doses at 25s.	1,667	10	0
Semen used by Farmers — 17 doses at 15s.	12	15	0
Mileage — 6,705 miles at 1s. per mile	335	5	0
Gwelo			
Semen used by Inseminator — 635 doses at 15s.	476	5	0
Semen used by Farmers — 1 dose at 15s.		15	0
Mileage — 6,319 miles at 1s. per mile	315	19	0
TOTAL	£6,944	15	8

Conception Rates

Period	Totals			Repeats			
All Centres	C/R %	1st	N.R.	1st	R.	Totals	R. %
July to September, 1958 . .	74·3	366	272	366	301	667	45·1
October to December, 1958 .	66·0	477	315	477	270	747	36·1
January to March, 1959 . .	72·7	587	426	587	424	1,011	41·9
April to June, 1959 . . .	73·1	789	577	789	390	1,179	33·0
Centre							
Salisbury	65·4	947	619	947	818	1,865	43·9
Bulawayo	76·5	951	738	951	414	1,365	30·3
Gwelo	72·5	321	233	321	153	474	32·0
ANNUAL TOTALS . . . (All Centres)	71·6	2,219	1,590	2,219	1,385	3,604	38·4
C/R %			71·6				

Conception Rates. Conception rates are calculated in exactly the same way as United Kingdom conception rates and are based on "90-day non-return" figures.

The results shown above must be regarded as very satisfactory indeed. Herd checks in the Salisbury area show that these figures are significant.

The percentage of repeat inseminations being performed is a very significant figure since it is known that when a service is operating efficiently approximately 40 per cent. of all inseminations performed will be repeat inseminations. It will be seen that the Department is performing less that 40 per cent. repeat inseminations (38.4 per cent.) The Bulawayo results are surprisingly high. This centre has operated entirely on deep-frozen semen throughout the year, and the results obtained certainly show that the deep-frozen semen produced in Salisbury can be expected to give good results.

Centres. At present three A.I. centres are being run, namely Salisbury, Gwelo and Bulawayo—all the semen being supplied from Salisbury. Salisbury and Gwelo are using liquid semen, which is collected thrice weekly, while Bulawayo operates completely on deep-frozen semen.

A new scheme of 25s. per insemination including mileage was instituted in February, 1959, in the Bulawayo area. This scheme, which was launched with considerable publicity, has proved a success mainly owing to the gratifying support afforded it by the Bulawayo area farmers. A similar scheme was introduced in the Salisbury area in May, 1959, but the response has not been nearly so enthusiastic.

These three centres all operate on a 30-mile limit and it is becoming very obvious that with an increased demand for inseminations it is difficult for one inseminator to cover such an area satisfactorily.

From the Salisbury centre there has been forwarded to farmers who undertake their own inseminations, 1,773 doses of semen, representing a sum of £1,329 15s. While some of these users have large dairy herds others are small and therefore there is bound to be a deterioration in technique through lack of practice. There are no actual records which can be checked in such cases, but it is certain that the results are not satisfactory.

Bulls. Four Friesland bulls and one Jersey bull are at present standing at the centre. Unfortunately the Jersey bull is not registerable for pedigree calves but even so there has been a considerable increase in the demand for Jersey semen —718 doses as compared with 461 for 1958. This would appear to be most indicative of the need to obtain a high quality Jersey bull.

The general increase in the use of semen is encouraging but it nowhere reaches saturation of the potential demand existing in the areas served by centres, nor does it represent anything like the potential production of the bulls at present in the centre, which is somewhere in the region of 35,000 doses per annum.

The Use of Deep-frozen Semen. The presence of a company manufacturing dry ice in Northern Rhodesia will now enable us to obtain a more secure supply, so that the Department can expand the use of deep-frozen semen to Gwelo thus enabling them to obtain Jersey as well as Friesland semen. The Department can now use properly constructed dry ice cabinets instead of converted deep-freeze machines, which have served us up to date.

The importation of deep-frozen semen from a high quality bull in the United Kingdom by a private owner was not a success. It is difficult to state why this was so, because success has been achieved with previous similar importations. A check on the viability of the semen was instituted at each insemination and the semen, though considered to contain fewer sperms than our deep-frozen semen, was viable.

The nominated service supplied only 87 doses of semen in the Salisbury centre; Bulawayo, of course, since reserves of deep-frozen semen have to be kept in stock, the service is to all intents and purposes a nominated one.

Experimental Work. The experimental field-trial with Illinois Variable Temperature Semen was concluded during the year and the results were completely unsatisfactory. The experiment was carried out in conjunction with Matopos Research Station where 100 maiden heifers were made available for the experiment.

INVESTIGATION AND RESEARCH

Vibriosis

	Total	Specimens		Herds in which positive reactors were found
		Positive	Suspicious	
Banket	44	10	2	2
Bindura	68	5	7	2
Bulawayo	307	36	21	9
Chipinga	20	0	0	0
Gatooma	24	1	0	0
Gwelo	164	24	9	6
Marandellas	258	25	14	5
Northern Rhodesia	146	19	9	4
Nyasaland	38	25	4	1
Que Que	55	1	5	1
Rusape	350	19	12	2
Salisbury	1,711	255	61	20
Umtali	84	4	3	3
TOTALS	3,449	424	147	55

As the above table shows there has been a marked increase in the number of specimens tested this year. This is due to the adoption of the tampon test which has greatly facilitated field testing. The test is now established on a very stable basis and the only difficulty lies in producing sufficient antigen for our needs.

Most of the herds tested have been dairy herds but the small number of tests carried out on ranch stock indicates that the condition is just as common in this class of stock. Tests have been carried out in eleven ranch or beef herds of various sizes and infection was established in eight of the eleven herds tested.

The herds classified as positive in the above table are those in which positive reactors have been found. This does not necessarily mean that the disease was being spread by a bull or bulls at the time of the test. Reacting females may be present in a herd in which the bulls are not infected. The herd history, proportion and history of reactors, etc., must be taken into account in assessing whether disease is being transmitted by infected bulls.

The results show that infection is widespread in this country. So long as bulls are maintained in infected herds and breeding is by natural service, treatment is not entirely satisfactory, as there is always the chance that either a male or female will remain infective. Only the widespread use of A.I. can give satisfactory control of this condition. This should be carried out from approved centres with approved semen from disease-free bulls.

The Tampon Test and Contagious Abortion Diagnosis. All countries which are aiming at eventual *eradication* of contagious abortion, as distinct from control, are interested in finding a test which will differentiate between active infection and vaccinal reactions. As is well known, blood serum tests are of little or no value for this purpose. Since some authorities have claimed that tests carried out on vaginal mucus were effective for this purpose a series of critical tests were undertaken to determine whether this also applied to tampon tests. These tests, unfortunately, proved conclusively that the tampon test will not differentiate between active infection and vaccinal reactions.

Testing of tampons for C.A. is however, remarkably effective in revealing C.A. in a non-vaccinated herd, and thus tests for two diseases associated with

infertility and abortion can be carried out on the one specimen. The test must be used on a group or herd basis.

Epididymitis Investigations. Working on the theory that some forms of epididymitis might be caused by a local agent, tests were carried out to study the effects of bites of the bont-legged tick *(Hyalomma* spp.) on the scrotum of the bull. Eight bulls were used. Very marked reactions were obtained in two cases but once this reaction had disappeared (after several months) the scrota returned to normal. After a further period the two bulls were slaughtered and the testes and epididymes were found to be absolutely normal.

It appeared that even severe reactions caused by the bont-legged tick *per se* did not penetrate sufficiently deep to affect the *tunica vaginalis.* These bulls were stabled during the experiment.

It is possible under field conditions where the effect of bont-legged tick bites are accentuated by such factors as screw-worm infestation that the damage might be sufficiently deep to penetrate the *tunica vaginalis.*

Poisonous Plants. Investigations into plant poisonings have been rather sporadic in the past, usually only being undertaken when cases arose. During the latter part of the year, however, a systematic investigation into poisonous plants was commenced in collaboration with the Department of Botany. Collections of plants are undertaken by the Botany Department. The necessary samples are finely ground and fed by stomach tube to cattle, sheep and pigs. In view of the fact that the toxicity of a plant may vary with its locality we are investigating also those plants known to be toxic in other countries.

The following plants have so far been checked.

Drimia zom bonsis — non-toxic for sheep
Gnidia kraussiana — toxic for sheep
Gnidia microcephola — non-toxic for sheep
Urginea burkei — toxic for sheep
Urginea near indica — non-toxic for sheep

PARASITOLOGY

Routine. During the year 577 faeces samples were examined for the presence of helminth eggs and coccidia. *Filaroides osleri* was identified from a bitch imported from the Union of South Africa.

Seasonal Variation. Work on this investigation continued throughout the year on two flocks, one being run on an extensive system of veld grazing with supplementary feeding and no dosing, the other on an intensive system of rotation on irrigated one acre star grass paddocks with regular use of anthelminthics. While there has been no noticeable rise in egg counts under the extensive system, there has been a slight increase under the intensive.

In both these flocks there was a marked increase in egg counts around lambing time which dropped within a month, without treatment. A further flock is now under trial where the economics of a combination of raised nutritional level and a reduced dosing programme is being investigated.

Liver Fluke. Close contact has been maintained throughout the year with the Bilharzia Research Laboratory, in connection with the bilharzia and liver fluke eradication scheme.

Work on snail breeding is being continued but considerable difficulty has been experienced in keeping them alive for sufficient time to obtain *cercariae.*

Metacercariae, kept in water for one year, have been tested for viability. Although viable for four months they were non-infective for sheep at the end of a year.

An investigation of an outbreak of liver fluke in dairy cows in an irrigation area proved to be due to infestation of the drinking troughs with *Lymnea Natalensis.*

It is of interest to record that in Mashonaland at least, while the incidence of fluke infestation in cattle is very heavy, this condition does not cause heavy losses in sheep, in fact it is the exception rather than the rule to find a sheep liver condemned in the Cold Storage Commission for fluke.

Schistosomiasis. Surveys at Salisbury, Bulawayo and Fort Victoria Cold Storage Commission abattoirs revealed a very high incidence of bovine intestinal schistosomiasis.

In Mashonaland 1,239 cattle from 51 farms were examined. Farms from which cattle were examined were from widely scattered districts, bounded by Sinoia, Umvukwes, Somabula, Odzi, and Gwelo.

Adult schistosomiasis was seen in the mesenteric veins of 1,144 head (92.3 per cent.). No macroscopic lesions in the intestine due to these worms were seen. In 399 head examined at Fort Victoria, 283 (72 per cent.) were infected. In 871 head examined at Bulawayo, 308 (35 per cent.) were infected. Thus a total of 2,509 head in Rhodesia revealed an overall incidence of 69.15 per cent. There was no loss in weight gain observed in four lambs infected with schistosomiasis.

A separate survey on urinary bladders revealed a 3 per cent. incidence of visible lesions in 1,000 head.

There is a high incidence of infertility of unknown etiology in Rhodesia. As infertility due to schistosomiasis has been reported in humans, an investigation was carried out to find out if any schistosome eggs could be demonstrated in female genitalia. In 40 genitalia examined, schistosome eggs were demonstrated in only one ovary.

The taxonomic status of the genus is rather uncertain. Specimens were identified by Professor J. C. Buckley and Dr. Rayski as *Schistosoma bovis*.

All attempts to keep Physops snails in the Laboratory failed.

Stilesia hepatica. This parasite is of great economic importance in Rhodesia, since 95 per cent. of sheep livers are condemned due to its presence.

Attempts were made to find a drug which would affect it. The following were tried with no success:

Carbon Tetrachloride in oil.

Cupric acetoarsenite.

Mepacrine hydrochloride.

Dimidium Bromide.

Investigations into its life cycle continued. Numerous oribatid and other mites were collected, exposed to eggs of *Stilesia hepatica*, then examined for the presence of cysticeroids, or dosed to parasite-free lambs.

Suspected Mineral Imbalance or Deficiency. An annual deterioration in the condition of young stock after they were put out of the calf pens in spite of an apparently more than adequate diet, was investigated on a farm near Marodzi. After parasite problems and chronic diseases were ruled out, the whole problem appeared to be one of a mineral imbalance.

Haemoglobin estimations were sub-normal in 7 out of 10 samples.

Copper and molybdenum analysis on pastures revealed adequate levels of both minerals.

In four liver samples copper was found to be generally on the low side, and iron very low. Five groups were treated with the following mineral supplements for five months.

(1) Potassium iodine.

(2) Copper sulphate.

(3) Cobalt sulphate.

(4) A mixture of Cu, Co, Zn, Fe, I.

(5) Controls.

No difference was noticed in weight gain in all groups. All deteriorated in condition. The investigation continues.

Trypanocidal Drug Trials. Unfortunately due to an outbreak of disease in our mouse colony three strains of trypanosomes had to be abandoned due to lack of mice.

Prothidium. Work undertaken showed that prothidium administered to 12 head of cattle at the rate of 2 mg. per kilo protected them against needle challenge under stable conditions for 214 days, but not for 283 days.

Low Fertility in Ranch Cattle. Work on this problem continues at Charter Ranch.

An attempt to lessen the second calving year drop was undertaken by bulling heifers six weeks early so that they would obtain that period of extra rest before their second bulling period. These animals commenced calving in September but at

present it appears as if the unfavourable season may have an untoward effect on the experiment.

A comparison of three calving seasons of a group of 100 animals split between Charter and Grasslands, Marandellas, suggests that the increased nutritional level and growth rate of the young animal has a lasting effect on the fertility rate of the adult. It is evident from work undertaken that in the adult the effect of feeding is temporary and does not last beyond one season. Further work on the effect on fertility of the increased growth rate of the young animals is being undertaken.

MISCELLANEOUS

Visits by the Staff. Mr. J. B. Condy attended a Symposium on Helminthiasis followed by a training course on technology held by C.C.T.A. at Muguga, Kenya.

A short veterinary course for farmers was undertaken by the Laboratory staff in co-operation with the Salisbury District Staff at Gwebi College.

During the year lectures were given by Messrs. Philip, Condy and Christie at various beef, sheep, pig and poultry courses held under the auspices of the Conservation and Extension Department and various associations.

Dr. J. R. Philip gave a course of veterinary lectures at Gwebi College of Agriculture.

Publications by Staff. Agalactia of Sows caused by Feeding the Ergot of the Bulrush Millet, *Pennisetum typhoides*, by D. K. Shone, J. R. Rhilip and G. J. Christie: Veterinary Record 71 129-132.

Sarcostemma Viminale poisoning in Sheep and Cattle, by J. R. Philip, J. J. Jackson and D. K. Shone. Journal of South African Veterinary Medical Association *29* 319-320.

Several informative articles have been published in the Rhodesian Farmer on such subjects as Horsesickness, Quarter Evil, Enterotoxaemia of Sheep, Contagious Abortion and *Lantana camara* Poisoning.

Acknowledgement

I wish to acknowledge the loyal and willing co-operation of my staff throughout the year and also to thank those other Departments which have assisted us in various investigations.

C. J. CHRISTIE,

Assistant Director of Veterinary Services (Research).

REPORT OF THE DIRECTOR OF TSETSE AND TRYPANOSOMIASIS CONTROL AND RECLAMATION FOR THE YEAR ENDED 30th SEPTEMBER, 1959

1. INTRODUCTION

(a) *The South-Eastern Lowveld.* Up to the middle of the year the trypanosomiasis situation in the south-eastern lowveld continued to deteriorate; but with the starting of a combined bush clearing and insecticidal attack on the new Chiredzi River focus in July, the position eased somewhat. Nevertheless our appreciation of the Sabi-Lundi problem as a whole must be that the danger is as great, if not greater, than that which threatened the country when the Zambezi tsetse belt began to expand 45 years ago. Much remains to be done before we can be reasonably sure that the ranches and reserves of the Nuanetsi and Limpopo basins are safe from rapid invasion by *Glossina.*

(b) The Situation Elsewhere. Elsewhere the position during the year has remained unchanged or has shown an improvement. On the Chipinga border clearing north of Mount Selinda the use of insecticides along the bush edge appeared to prevent the usual wet weather crossing of the clearing by tsetse, so that the high infection rates observed in 1958 (the worst year since 1943) were followed by a year remarkably free of infection. In Mtoko the situation remained unaltered, although potential corridors for tsetse advance to the north and to the south of the operational area are a continual cause of concern. Trypanosomiasis in the native reserves in North Darwin is suggestive of a southward movement of *Glossina* in Portuguese East Africa and a tsetse survey here is desirable as soon as staff can be spared. In Sipolilo and Lomagundi east of the Chirundu Road, although there has been increased prospecting activity on the edge of the tsetse bush, the very satisfactory position has been reflected in the complete absence of trypanosomiasis for many months in cattle on the neighbouring farms. In north-west Lomagundi the introduction of cattle into the eastern half of the Urungwe Native Reserve has been a most welcome indication of further progress. The rising waters of Lake Kariba have had, as expected, no effect on the tsetse situation except, of course, to exterminate the flies from the flooded areas. The voracious hunger of the tsetse before their disappearance from newly formed islands from which game had been removed or had disappeared, has been noted by the game rescue parties. The Kariba situation will require watching for some years. In particular the movement of game into areas from which animals had disappeared may create conditions favourable to the subsequent advance of tsetse.

In the basin of the Sanyati River the position has remained unchanged. West of Gokwe, although cattle trypanosomiasis remains at a high level of incidence in the reserves bordering on the tsetse belt, there are indications that hunting between fences is now beginning to achieve its object. A notable feature here has been the establishment of an extensive bicycle patrol system which, in due course, will be extended to cover the tsetse front of the whole territory.

An unsatisfactory feature has been the failure to settle the Lubu Valley to the degree anticipated when the 1957 aerial spraying was planned. As a result tsetse fly is returning to the valley and it will become increasingly difficult and expensive to maintain the local cattle in good health. Moreover dispersed settlement surrounded by tsetse fly creates ideal conditions for the reappearance of human trypanosomiasis in one of the classical sites of Rhodesian sleeping sickness.

(c) Field Research Station. The Field Research Station at Kariangwe has been closed down and a new station opened on the Rekomitjie River in North Lomagundi. The Kariangwe Station has, for several years, been a most valuable feature of the services maintained by the Department, but its inaccessibility was a disadvantage. The new station is within a day's run of Salisbury.

(d) Methods of Control in Use. Game destruction is still the major control technique in use and this will continue to be the case, at any rate in the Zambezi area, for another three or four years. An analysis of labour wages paid out on

various categories of work for the financial year ended 30th June, 1959, is as follows:

Hunting	32·48%
Traffic Control	18·25%
Bush Clearing and Control	17·22%
Fencing	13·19%
Road Construction	8·27%
Miscellaneous	10·57%

Such a table does not entirely reflect the importance of various techniques. Thus although very little labour was used in the application of insecticides, expenditure on this item (including spraying machinery) was three times as great as expenditure on arms and ammunition.

(e) Maps. A new feature of the Department's activities this year has been the employment in Salisbury of an officer whose time is very largely taken up with cartographical work. Certain areas of Southern Rhodesia are still inaccurately mapped and, not unnaturally, these tend to be in the uninhabited tsetse-infected portions of the country. Elsewhere, where accurate maps exist, it may be desirable to convert to other scales or to add features not included in the sheets produced by the Federal Surveys Department. Finally the Department produces its own original maps of vegetation, tsetse distribution, etc. The provision of good maps results in a considerable saving of time of officers working in the field (who would otherwise have to produce their own) as well as promoting greater accuracy.

(f) Staff. The staff position has shown some improvement, in spite of the departure of Mr. R. J. Phelps, Entomologist, who left to take up a Fulbright Fellowship in the United States. Mr. Phelps made several notable contributions to the work of the Department and his services during the recent Sabi crisis were most valuable. In his place Mr. R. D. Pilson has transferred to the Department from the East African Trypansomiasis Research Organization and Mr. C. A. R. Savory has joined after service with the Northern Rhodesian Game and Tsetse Department. The very rapid turn-over of staff among the Field Officers now seems to be coming to an end. At the time of writing there are two professional officer vacancies, while the Field Officers are also two below strength. Strenuous efforts have been and are being made to build up and train a corps of African Field Assistants, essential if adequate coverage of the tsetse front is to be achieved.

(g) The Trypanosomiasis Section, Veterinary Department. It is not possible to review the tsetse situation adequately without reference to the work of the Trypanosomiasis Section of the Department of Veterinary Services. During the year some 70,000 head of cattle were maintained in good health in proximity to the tsetse front by the use of drugs, both prophylactic and curative. The intensity of drug treatment varied from place to place but over all the dosage rate, mostly with antrycide methyl sulphate was just under one dose per beast per annum. The drug campaign, which is organized on a basis of inspections carried out at weekly dippings, is complementary to tsetse control operations. Without the latter the use of drugs, in some areas, would become impracticable; without the drugs, depopulation following the inevitable death of livestock would encourage the spread of tsetse fly and increase the difficulties of control. Collaboration between the two departments has been very close and friendly, but it has become evident that there would be great advantages in uniting both attacks on the problem—the attack on the tsetse fly and the attack on the disease by drug therapy, under one head. Discussions have therefore been held on a proposal to form a branch of the Department of Veterinary Services which will absorb the present Department of Tsetse and Trypanosomiasis Control and Reclamation.

(h) Inter-territorial Meetings. Two noteworthy meetings have been held to discuss problems of material interest with officials of neighbouring territories. In September, excluding one officer from Northern Rhodesia who was unfortunately sick, all the professional biologists engaged in tsetse control work in the Federation met for three days at the new Rekomitjie River Research Station. They were joined by two members of the staff of the University College of Rhodesia and Nyasaland who are engaged in research on *Glossina*, and by the Tsetse Fly Control Officer of the Bechuanaland Protectorate. The second meeting brought together officials concerned with tsetse and trypanosomiasis in the Union of South Africa, Mozambique and Southern Rhodesia to discuss the possibilities of closer collaboration in dealing with the southerly advance of *G. morsitans* and *G. pallidipes* in the Sabi-Lundi basin.

2. DISTRICT REPORTS

A. Sebungwe—By D. F. Lovemore, Entomologist.

(1) Introduction

During the period October, 1958, to September, 1959, the hunting operations have continued satisfactorily. New methods have been tried, the emphasis being on greater hunting efficiency.

Certain surveys and investigational work were carried out.

Generally progress in all aspects of the work in the Sebungwe area has been good.

(2) Reclamation and Control Operations

(a) Hunting Operations. The hunting operations which are designed to create a game- and tsetse-free belt north of the settled Lutope, Kana, Mzola and Lubimbi areas, the organization of which was described in the 1957-58 report, have continued satisfactorily and it is pleasing to record that there are signs that these are taking effect.

The hunting was carried out throughout the year by a team of "regular" .303 hunters which varied in number from 120 to 130 Africans, by a number of casual .303 hunters consisting of gate guards, supervisors and fence maintenance staff and by a team of shotgun hunters. The shotgun hunters varied in number from five hunters for the period November, 1958, to May, 1959, to 12 hunters from June to September, 1959; this method was entirely a new idea and will be described in more detail below. The hunting can generally be considered to have been carried out at a density of one hunter to ten square miles. All the hunting operations were supervised by one senior field officer and three field officers; for a short period a fourth field officer was stationed in the area.

The shotgun hunting method as mentioned above is entirely new and was devized in an attempt to speed up the control of certain species of the small game population, namely reedbuck, duiker, steenbok and Sharpe's grysbok. These hunting operations are conducted at night during the moonless period using 3-cell torches mounted on the shotguns. Each hunter has a labourer assistant; this is essential for morale. Shotgun hunters do not have fixed camps as do their .303 counterparts, but are moved frequently around the area to wherever populations of small game are noted to occur. The efficacy of the method is best gauged by comparing shotgun results with those of .303s as follows:

(i) During the period under review shotgun hunters shot 9.11 head of game per hunter per month as compared to 3.99 head of game per "regular" .303 hunter per month. The superiority of shotgun hunters was of course most pronounced in the dry months and especially after the grass was burnt, e.g. in September, 1959, shotgun hunters shot 15.08 animals per hunter as compared to 4.82 per "regular" hunter with .303s. These differences would be even more accentuated if only the small game totals for .303 hunters were considered.

(ii) During the period under review shotgun hunters used an average of 1.69 rounds per animal for 765 animals shot, whereas "regular" .303 hunters used an average of 3.99 rounds per animal for 6,045 animals shot.

It is most important to stress here that this shotgun method is essentially only effective for small game such as duiker, steenbok and Sharpe's grysbok and would, therefore, always have to be used in conjunction with rifles. Other species were shot during the past year, namely baboon (17), wild dog (1), zebra (1), bushpig (10), warthog (14), tsessebe (1), reedbuck (24), kudu (1), bushbuck (2) and impala (11) but not with the same regularity as the duiker (549), steenbok (76) and Sharpe's grysbok (57). Reedbuck have proved a difficulty since they will not stand for a bright light. There is a suggestion however that a weak light is more attractive and experiments are in progress along these lines.

Another new idea tried out during the past year has been the control of water holes in the hope that the game animals would tend to leave the operations area in search of other water. The control was achieved by spraying all isolated surface water with diesoline and BHC (surplus from the aerial smoking campaign of 1957); this rendered the water quite unpalatable and animals have avoided these places ever since.

During the period under review 7,147 animals, other than elephant, were destroyed and of this number 87.88 per cent. were small animals, that is duiker,

steenbok, Sharpe's grysbok, warthog, bushpig and baboon. An analysis of the hunting returns also indicates the following:

(i) It would appear that the warthog population is on the decline; this is shown when the totals of warthog killed for the periods July, August and September, 1958, and the same months in 1959 are compared. The reduction is in the order of 50 per cent.

(ii) The month to month figures clearly show a marked effect of season on the hunting. From this it is concluded that the hunters are now hunting intensively and not simply for their personal needs and furthermore that the control of hunters is satisfactory.

The control of elephant has been continued once again by the combined efforts of the Game Department, Wankie National Parks staff and our own field officers. The problem now is only one of occasional incursions by elephant from the north through the fence, from the east between the fences and from the Gwaai on the south-west between the fences. A total of 60 elephant were destroyed in the operations area during the year.

In order to follow the effect of hunting operations on the tsetse population a system of thirty bicycle fly-rounds were laid out throughout the operations area early in July together with two controls north of the fence. All fly-rounds are six miles long with one-fifth mile stops and follow roads and tracks. Catches are made twice monthly. It is as yet too early to comment on results.

The game fence was maintained efficiently throughout the year. There were very few breaks through by game.

About 500 miles of roads were maintained and some 40 miles of new roads were cut within the operations area.

(b) Traffic Control. In the light of the very satisfactory drug campaign being conducted in the southern Sebungwe by the Veterinary Department the problem of tsetse carriage by traffic was reconsidered during the year and it was concluded that the funds for at least seven of the thirteen traffic control points in the Sebungwe area could be spent to far greater advantage on actual reclamation within the operations area.

As a result of this decision three gates on the cattle fence, the two in the Mzola-Dongamusi rivers area, the one on the Kana River and the one at the game fence crossing of the Manyande River were closed.

Gates remaining are those covering the four main access roads to the Sebungwe, namely, the Binga-Kamativi road, the Binga-Siabuwa-Gokwe road, the Binga-Kariangwe-Lubimbi road and the Binga-Kariangwe-Cewali-Gokwe road. Sefula gate was also retained as this covers traffic proceeding from a particularly heavy tsetse density towards the southern settlements.

It was found necessary to move the gate controlling the Binga-Kamativi road from the junction of the Binga-Kariangwe road and the Binga-Kamativi road to just west of the Matibi River near Natulwe Hill.

A "swingfog" machine was used throughout the year at Mzola gate on all southbound motor vehicle traffic.

(c) Aerial Smoking Campaign: Lubu Valley. The regular observations, which have been made on the fly-rounds within the Lubu Valley throughout the year, in order to follow the results of the aerial smoking campaign of 1957, indicate that the tsetse population is now rapidly recovering. This is most disappointing especially since it is believed that had the Batonka settlement been of the order originally envisaged the position achieved by the aerial smoking could have been consolidated. It might be as well to add that this deteriorating situation within the Lubu Valley must be viewed with considerable concern since the ever increasing trypanosome challenge could very well spell the doom of the Siansali cattle; these cattle are at present under drug protection. Nor should the possibility of human trypanosomiasis be overlooked.

(3) *Survey and Tsetse Distribution*

Once again the survey aspect has been neglected and an area mentioned in last year's report as requiring early investigation still remains a blank, namely, the area lying north of Gokwe and between the Sebungwe and Sanyati shooting operations areas. This state of affairs is to be attributed entirely to a lack of trained staff. It is hoped however that the position will improve during the coming year.

A short survey was carried out in the Karna Block ranch area during October, 1958, in order to investigate a small outbreak of cattle trypanosomiasis which had occurred on the ranch. No tsetse were found. Observations made suggested that the cases were probably the result of "carried" tsetse from the Dongamusi-Mzola area to the north east; this is a danger which will continue until we have achieved our object in the shooting area between the fences. It was also noted that there is little likelihood of an advance of tsetse occurring from the Dongamusi-Mzola area into the Karna Block since extensive, almost treeless zones, called Sidaga Flats, separate these two areas.

It is of importance to mention that the tsetse situation in the area west of Kariangwe and to the north of the western end of our shooting operations seems to have deteriorated. Reports by field officers, gate guards at Natulwe gate and by Africans from Chief Dobola's country on the Nagupande suggest this. A further survey would appear necessary. It is hoped that it will be possible to institute reclamation measures in this area in the coming year and so consolidate the western end of the tsetse front.

(4) Investigational Work

Investigational work was restricted by the many administrative problems of the reclamation operations and also once again by the lack of trained staff. The only work carried out was a study by Miss Leggate of the trypanosome infection rate in *G. pallidipes* in the Lubu Valley and the collection of puparia, both *G. morsitans* and *G. pallidipes* for laboratory work in Salisbury.

(a) Trypanosome infection rate in G. pallidipes. Miss Leggate dissected 370 *G. pallidipes* collected at Gwababa in the Lubu Valley between the 27th October and the 21st November, 1958, and of these 23.5 per cent. were found to be infected. Of these a very large proportion (17.3 per cent. of all flies) appeared to be due to the *vivax* group, only 5.1 per cent. being attributed to the *congolense* group. Four salivary gland infections were detected (1.1 per cent.); these trypanosomes being assigned to the *brucei* group. The infection rate is 137 female flies was found to be higher (27.7 per cent.) than in 233 male flies (21 per cent.) It is possible that the sample was not sufficiently large to give an accurate picture and it is hoped to continue the work at the Rekomitjie field research station.

(b) Puparia collecting. Puparia collecting was continued until the end of November, 1958, when the work was suspended for the rains; the work was started again at the beginning of June, 1959, and has continued since.

All puparia have been forwarded to Dr. Barrass and more recently also to Dr. Bursell of the University College of Rhodesia and Nyasaland.

It is interesting to note that with the breaking of the rains early in November, 1958, puparia searching became more difficult (14,280 *G. morsitans* and *G. pallidipes* puparia were collected in October whereas only 3,431 puparia were collected in November); this is attributed to the wet soil conditions prevailing, the dispersal of the adult females and the consequent use of random sites and to the destruction by floods of puparia deposited before the rains along the river beds.

Another point of interest is that the shift on to the riverine pupal sites by *G. morsitans* occurred in this present dry season in August whereas in 1958 it occurred in September. This shift is clearly indicated by the appearance of mixed collections of *G. morsitans* and *G. pallidipes* puparia; *G. pallidipes* puparia have as yet not been found in the mopane woodland and escarpment foot slope areas.

B. Urungwe Area—by R. Goodier, Entomologist

(1) *Introduction*

During the past 12 months no marked change has taken place in the tsetse and trypanosomiasis situation in the Urungwe area, which remains fairly satisfactory. There have been some cases of trypanosomiasis on the Karoi European farms and one case amongst the native cattle on the Crown lands to the north east of Miami. All the evidence suggests that these cases were either due to tsetse carried on traffic or to cattle being grazed in areas close to the edge of the known fly belt. There is nothing to indicate an advance of tsetse into these areas.

Advantage has been taken of the present satisfactory situation to reorganize the administrative arrangements and the distribution of officers in the area. The area headquarters have been moved from Magunge to a more central position on the main road at Makuti where accommodation for a resident entomologist and senior field officer is provided in the form of two prefabricated houses. The field

officer in charge of game destruction in the Kariba section has been moved from Vuti to Kariba where it is hoped that permanent accommodation will be available for him in the near future.

The field station on the Rekomitjie River below the escarpment which was acquired by the Department at the end of last year is now being developed as a centre of research work on problems relating to tsetse and trypanosomiasis control and was the venue for the inter-territorial meeting on Tsetse and Trypanosomiasis Control which was held in August, 1959, and attended by delegates from the three Federal territories, Bechuanaland and the University College of Rhodesia and Nyasaland.

(2) Control and Reclamation Measures

(a) Kariba Section. The game fence from the Gache-Gache Gorge to Makuti was completed, except for one mile in the Makuti township area, by the end of July. Hunting operations were commenced in the area south of the fence at the end of the rainy season with 25 hunters under the supervision of the local field officer. The hunting operations in this area were hampered to a certain extent by the fact that the hunters and their families were involved in the movement of Africans from the Crown lands to the Urungwe African Reserve and had to be given time off for this reason. A certain amount of damage has been caused to the new fence by the larger game animals, due to some extent to the disturbance caused by poaching in the Kariba area.

(b) Umniati East Section. Forty hunters have been employed on game destruction in this section from the Fulcchi River northwards to the escarpment. Changes in European staff in this area resulted in temporary difficulties in the supervision of the hunting. It is hoped that satisfactory control will be achieved now that an experienced field officer has been stationed in the area. The catch of only 19 *G. morsitans* from eastbound traffic at Chiroti Gate during the year, compared with 41 last year, indicates that a satisfactory degree of control is being attained by the game destruction operations in this area.

In the southern part of this section further native resettlement has consolidated the gains made by the Rengwe Reclamation Scheme. Small numbers of tsetse are still to be found fairly close to the Rengwe near the Sanyati River. The complete elimination of tsetse close to the Sanyati is unlikely to be achieved at present due to the proximity of the uncontrolled tsetse areas in Gokwe Disrict, but it is hoped that the further development of native settlement will render the area unsuitable for permanent reinvasion by tsetse.

To the south of the Rengwe area, between the Msukwi and Piriwiri Rivers, no control measures are being employed at present but survey work has been instituted to investigate the possibilities of this area being reinvaded from the Gandervaroyi area to the west of the Sanyati. In the north of this section an experimental insecticide scheme was undertaken at Kapondo at the end of 1958. This will be discussed in greater detail below.

(c) Urungwe African Reserve. The main item of note in this section was the reintroduction of cattle into the newly-fenced area of the eastern part of the eastern half of the Reserve commencing in June, 1959. The reintroduction of 400 head has been approved and of these about 180 head have already been brought in. The cattle are regarded as being in the nature of a test herd, which will give a good indication of the degree of success in tsetse control which has been achieved in this area since the cattle were moved out in 1952 due to heavy losses caused by trypanosomiasis. So far the introduced cattle have remained free of trypanosomiasis but it is as yet too early to make a full assessment of the situation. From knowledge of the tsetse and trypanosomiasis situation in the Urungwe area generally it is to be expected that the occasional case of trypanosomiasis may occur but the rapid development of the Urungwe Reserve and the decline in tsetse density to the west of the Reserve should render any large influx of tsetse with resultant trypanosomiasis extremely unlikely.

(d) Rekomitjie Section. No control measures have been applied to this section during the year. The tsetse position appears to be fairly stable. It is hoped that surveys in the near future will enable a plan of action to be drawn up for this section.

(3) Surveys

A case of trypanosomiasis amongst the cattle belonging to Chief Kazungarare's people on the Crown lands to the north-east of Miami led to a survey being carried out by the field officer, Mr. C. W. Howard-Beard, in that area extending to the

Angwa River. No tsetse were found but circumstances indicated that the increased traffic in the area due to mining activities may have resulted in some tsetse being carried into this area.

(4) The Rekomitjie Research Station

Development of the old Rekomitjie Mission on the Rekomitjie River at the base of the Zambezi Escarpment commenced in July when a field officer was put in charge of the station. It was decided to provide additional accommodation for workers at the station in the form of small chalets or rondavels. Construction of these has been delayed by the water shortage but will commence at the beginning of the rains at the end of 1959. Accommodation difficulties and the water shortage have not prevented the commencement of research at the station. Following the Inter-territorial Conference, Dr. R. Barrass of the Department of Zoology at the University of Rhodesia and Nyasaland remained at the station and undertook experiments on the relative attractiveness of different coloured screens to *G. morsitans*.

African staff have been trained in the technique of the dissection of tsetse in preparation for work on the isolation of metacyclic trypanosomes.

Very large populations of both *G. morsitans* and *G. pallidipes* have been located in the immediate vicinity of the station.

In addition to its development as a research centre the station will also be utilized as a training school for African Field Staff.

(5) The Kapondo Insecticide Experiment

In August and September, 1958, a small experimental insecticide scheme was undertaken in the Kapondo area in the north of the Umniati East section. It was intended to attempt to eradicate *G. morsitans* from the area of the Upper Urengi watershed (about 16 square miles) by the application of a solution of dieldrin as "Dieldrex" to as large a proportion as possible of the dry season resting sites of tsetse within the area.

The first application was commenced on 6th August and completed on 14th August. A total of 689 gallons of 1.8 per cent. dieldrin was used. One "Motobolo" machine and three "4 Oaks" sprayers were employed to apply the insecticide.

As the experimental fly-rounds within the area indicated residual "pockets" of tsetse, a second application of 130 gallons of 3.7 per cent. dieldrin was applied to these in the third week of September.

It was unfortunate that the comparatively cold overcast weather at the beginning of August resulted in low availability of tsetse in the area before the commencement of the spraying and probably delayed the hot season defoliation of the vegetation. The comparatively low availability of tsetse made the assessment of results difficult but the available data indicated that the spraying operations had resulted in an 85 per cent. reduction in the availability of *G. morsitans* within the area. This percentage reduction is unsatisfactory and the remaining tsetse would, in normal circumstances, quickly recolonize the area. However as the area treated was not isolated from the surrounding low density tsetse populations, some of the apparent residual population may have been due to reinvasion from outside the area.

This experimental scheme was useful in demonstrating the many difficulties inherent in the control of *G. morsitans* by the ground application of residual insecticides.

C. Sabi-Lundi Area

(Note: Until June this area was in the charge of Mr. R. J. Phelps, Entomologist. The following account is based on his Monthly Reports and the Annual Reports of Mr. E. L. Thomas, Senior Field Officer, and Mr. J. A. Farrell, Entomologist, who has been responsible for the planning of the mechanical clearing operations and the Chiredzi Insecticide Scheme).

(1) *Introduction*

The appearance of nagana on the Lone Star Ranch in the Chiredzi Intensive Conservation Area noted in last year's report resulted in a decision to intensify defence measures on potential lines of tsetse advance. A bulldozing unit began work on the Mkwasine River vegetation in December, 1959. Meanwhile further infections on Lone Star suggested that the main focus was on the Chiredzi River

and, although at the wrong time of year to get maximum effects, a spraying operation using DDT wettable powder was carried out on all thicket edges along the Chiredzi River from the Chidumo Clinic south to the Lundi in April, 1959. During the same month the rightness of the decision to concentrate effort on the Chiredzi was confirmed by the capture of two *G. morsitans* and one *G. pallidipes* near the Chiredzi-Lundi confluence. These captures meant that tsetse had overrun the boundary of the Sabi West shooting area by over twenty miles along the line of the Lundi River. It was therefore decided to abandon the Sabi West Shooting Scheme and to concentrate as much of our resources as possible upon defences based on the vegetationally unfavourable zone of black basalt soils which lies across the lines of potential tsetse advance to the west and the north. In July the bulldozing team moved from the Mkwasine River to the Chiredzi and in September a second, more intensive spraying operation using dieldrin was carried out.

The Sabi East game destruction campaign on the Makossa hills, which, at the end of the 1958-59 shooting season was showing favourable results, has been continued. The Hondi River discriminative clearing operation was completed in May. In the north, however, the high level of infection in the Musikuvanthu cattle and the extension of infection into the Humani and Devuli Ranches west of the Sabi, is still an unsolved problem although surveys with bait oxen and pigs have been in operation for four months Meanwhile, south of the Lundi River, surveys suggested that tsetse is continuing to spread in the Gonakudzingwa area. So far, however, there has been no deterioration in the nagana situation in the Matibi II Reserve.

(2) *Investigational Work*

(a) Tsetse Surveys. The task of defining the limits of the tsetse belt continues. The map shows its maximum extension during the year, as defined by actual captures of tsetse. Whether the operations now in progress will eliminate the salient of both *G. morsitans* and *G. pallidipes* along the Lundi to the Chiredzi confluence remains to be seen. South of the Lundi River *G. morsitans* has recently been taken west of Nyamatongwe Hill. There is, however, little indication of movement in a south-westerly direction and on the international border our surveys give results in agreement with those of the staff of the *Missao de Combate as Tripanosomiases* of Moçambique. It should be noted, however, that in November, 1958, two teneral female *morsitans* were captured in a Land Rover on the Border Road six miles north-east of Malvernia. There is little doubt that these tsetse had been carried on road traffic and did not represent a true advance. Since then the Portuguese authorities have erected a de-flying chamber on the Border Road. The capture of a single female *G. austeni* at the Rusungwe Gate in October on traffic moving from Southern Rhodesia into Moçambique is of interest. Searches particularly in the apparently suitable "Mahenya's Thicket" failed to yield another specimen. There may well be a small focus of *G. austeni* in Southern Rhodesia which so far we have failed to locate. A belt of *G. austeni* has been found by the Portuguese workers in the valley of the Rio Save west of Massangena and therefore some fifty miles nearer to the Rhodesian border than had previously been known. In the north of the Sabi area the only change results from the capture of a single female *G. morsitans* on the Nyamakamba River, about half a mile from the border and a mile and a half north west of Beacon 103A.

The few positive records on which the position of the tsetse front is assessed give little indication of the extensive organization for survey work which has been built up during the year. Bait cattle and, in the Musikwanthu Reserve, pigs as well are in use. Here four months of continuous patrolling has failed to reveal any tsetse although the area is one in which infection is continual and extensive.

(b) Vegetation Surveys. The advance of tsetse into the Chiredzi area involved extensive surveys to locate and plot areas of bush suitable for the maintenance of the fly in the black basalt zone. This area carries for the most part a sparse woodland of poorly-grown mopane or mopane scrub broken at intervals by extensive treeless grassland. This open country is most extensive in the Matibi II Native Reserve south of the Lundi River. The basin of the Musaswe River east of the Sabi also contains much land unfavourable to tsetse fly. The section of the basalts in the area between the Sabi and the Lundi is less inhospitable; in part because it is traversed by the two relatively large drainage systems of the Chiredzi and Mkwasine Rivers each bordered by alluvial soil carrying well developed woodland which never becomes entirely leafless; and in part because granitic hills reduce the width of the unfavourable basalt area along the line of the Sabi. The task of mapping the distribution of vegetation types in the basalt is not yet completed but 1,100 square miles have now been surveyed between the Sabi and the Lundi.

(c) Fly-rounds. Patrolling of fly-rounds in the Makossa Hills east of the Sabi has continued. A detailed analysis of the year's data has yet to be made, but the following points may be noted. The intensive hunting campaign in the *Brachystegia tamarindoides* woodland has continued and appears to have resulted in a marked decline in density of *G. morsitans*, with an accompanying increase in the percentage of females caught. On the Makossa round which has been in operation for three years the normal season cycle has largely been obliterated. However, present indications are that the rate of decline of tsetse fly numbers is now less rapid. An initial rapid reduction followed by a much slower decline over several years is a feature of most reclamation schemes depending on the modification of density dependent factors. In the present case it is unlikely that complete elimination will be achieved since the shooting area will always be open to invasion by tsetse bred on the Portuguese side of the border game fence.

One result of the decline in tsetse numbers is that observations on their distribution in relation to vegetation are less easy to make. However, one observation made towards the end of the 1958 dry weather is of interest. The *morsitans* habitat on the granite hills comprises a well-developed woodland of *Brachystegia tamarindoides* underlying which is an extensive deciduous thicket. Where drainage lines develop in this woodland, there is often a small open vlei. During the wet months, when the lower storey thicket of the woodland is at its densest, catches of *G. morsitans* are highest in and around the vleis. In October at the height of the dry weather it was found that the concentrations around the vleis had disappeared and that tsetse were dispersed throughout the woodland. This is an interesting reversal of what is commonly observed, of concentration in the hot dry months, with dispersal in the rains. It is attributable, no doubt, to the somewhat unusual formation of the vegetation. The usual habitat of *G morsitans* is comprised of woodland which does not contain an underlying second storey except as a narrow band around the margins of vleis and along drainage lines. It is this thicket and low tree formation which provides the main habitat in the dry weather when the main woodland is leafless. During the rains when the canopy is in full growth the tsetse is able to disperse throughout the woodland. On the Makossa Hills thicket is fairly continuous throughout the woodland. Continuous thicket is not favoured by *G. morsitans*. It thus happens that during the wet weather, when the deciduous thicket is in leaf, dispersal is inhibited and a wet season concentration occurs on the thicket margins around the vleis and the edges of the *Brachystegia* woodland. This reversal of behaviour suggests that these woodlands might not provide a suitable medium for discriminative clearing of the drainage line type. It is hoped that we may be able to find a suitable area south of the Lundi River where an attempt can be made to repeat these observations.

One feature of *morsitans* behaviour was shown to be quite normal. All day catches at different seasons showed that in the hot dry weather (October) maximum catches were made in the early morning (6 a.m.) and the evening (6 p.m.) whereas in the cold weather (July) a single maximum catching period occurred from midday to 2 p.m.

(3) Communications

About 90 miles of new bush roads have been made and some 280 miles maintained. Most of the new roads are in the fly-infested area south of the Lundi. A new road has been opened by the Shabani Mining Company between Marumbene and Chikumbedzi for the purposes of labour recruitment. This will provide a useful means of access to the South Lundi fly belt in the coming year, but meanwhile provides additional problems in cleansing traffic. The road from Lone Star to the Ndanga East Reserve has been greatly improved by the Native Affairs Department using funds supplied in part by Tsetse Control and in part by the Roads Department.

(4) Control Measures

At the beginning of the year four main operations were in progress, the Sabi West and the Sabi East Game Destruction Scheme and the Rupembe and Hondi River Discriminative Clearing Scheme, and the Bandai Clearing Scheme. The two latter schemes are now finished, the first has been abandoned; while the Sabi East Scheme is the only one remaining unaltered and also the only scheme in which game destruction plays a part. During the year, however, the very large task of modifying the vegetation of the black basalt zone so as to form an adequate barrier to further advance of tsetse has begun. These various schemes are now considered separately.

(a) The Sabi West Game Destruction Scheme. This scheme was devised in 1955-56 to destroy all game in an area of about 400 square miles bounded on the east and south by the Sabi and Lundi Rivers, respectively, and on the west and north by a game fence. It was planned to use 80 hunters and although in 1957-58 this number was almost achieved, in 1958-59 only about 40 hunters could be recruited. In the first season's hunting the target had been 2,000 head but only 1,542 head were achieved. The 1958-59 season failed to make up the shortfall and in fact only 1,438 animals were shot. The season ended in February and a third season was due to begin in June, 1959. However, in April, the capture of tsetse on the Chiredzi River made it quite clear that the scheme had failed in its object of halting the westward advance of the tsetse. In any case it did not cover the country south of the Lundi River where an extensive advance had also been noted. It was therefore decided to close the scheme down and to lift up the game fence from the northern face of the Chuhonja Hills southward.

It was also decided at the same time that an appendage to the Sabi West Scheme, a fenced corridor five miles wide along the western edge of the Sangwe and Ndanga East Reserves should be abandoned as a hunting area. A brief attempt to start hunting in this zone was made in November, 1958, but not continued because of lack of sufficient hunters. The main path by which tsetse might cross the zone, the Mkwasine River, was treated by mechanical bush clearing in the succeeding months (see below).

The abandonment of the Sabi West shooting scheme drew attention to the long standing problem created by the presence of animals with a high nuisance value in the ranches and reserves of the Sabi-Lundi basin. A scheme for the control of elephant, buffalo and zebra in the area is now being considered by the Southern Rhodesian Game Department. If we are to look to the intensification of land utilization by farmers, both European and African, as providing the only sure and satisfactory end to the tsetse problem, then the wild game must be managed and controlled as part of that process. Elephant and buffalo in contrast to most other species of wild game would seem to have habits which could lead to their becoming vehicles for carriage of tsetse fly. Thus even where reliance is to be placed on bush clearing or insecticides as the main weapons of tsetse control, it is desirable that these animals should be confined within recognized areas and not allowed to wander back and forth between the fly belts and the occupied lands.

(b) The Sabi East Game Destruction Scheme. Between the east bank of the Sabi River and the Portuguese border tsetse was concentrated in the *Brachystegia tamarindoides* woodlands on the Makossa Hills. Dispersed shooting had been carried on in this neighbourhood since 1940 but had failed to prevent a build up of the tsetse population. At the start of the 1958-59 hunting season, in June, 1958, all hunting was concentrated in the Makossa hills where, in an area of 80 square miles, 40 hunters were established. From November, 1958, onwards, five hunters were also armed with shotguns for night shooting with lamps. The effect on the tsetse appeared to be most marked, the two seasonal peaks, the first during the rains (February-April) and the second at the beginning of the hot season (July-September) being eliminated. This failure of the fly population to build up at the expected time was accompanied by a marked increase in the percentage of female and teneral flies caught. Unfortunately, as is so often, and of necessity the case in reclamation operations, no control fly-rounds could be operated, and it is as yet too early to pronounce definitely on the success or otherwise of the Sabi East Scheme.

During nine months' shooting with .303 rifles, 40 hunters killed 907 animals, of which duiker comprised 48.1 per cent.; baboon, 9.8 per cent.; bushpig, 9.4 per cent.; kudu, 6.3 per cent.; nyala, 6.2 per cent.; and bushbuck, 2.9 per cent.; 3.39 rounds were used per animal and 2.75 animals were killed per hunter per month. In addition five men armed with shotguns, operating from November to February, and 11 from June to September, killed 312 animals, of which duiker comprised 68.6 per cent.; Sharpe's grysbok, 8.3 per cent.; bushbuck, 2.2 per cent.; baboon, 1.3 per cent., and warthog, 1 per cent. The number of rounds used per animal was 2.36, and 5.2 animals were killed per hunter per month.

(c) The Rupembe and Honde River Discriminative Clearing Scheme. The scheme is now completed. It consisted in the felling of trees on the alluvial soils of the drainage systems of these two rivers which run south-eastwards across the international boundary between Beacons 105 and 108. On their lower reaches these rivers in Moçambique are comparatively heavily infested with *Glossina.*

(d) The Bandai Hand-clearing Scheme. This area, of approximately 4,000 acres, was sheer-felled, at a cost of 14s. per acre for wages, rations and transport. It lies at the southern end of the Ndanga East Reserve and its presence may be

responsible for the continued relative freedom from infection of cattle at the Peri and Rupangwaan dips. It is hoped that the management of this clearing with a view to suppression of regeneration and encouragement of grass growth will be taken over by the Native Affairs Department.

(e) The Mkwasine Mechanical-clearing Scheme. The first indication that tsetse had advanced beyond the Sabi West shooting area came in July, 1958, with the infection of cattle on the Lone Star Ranch. Two lines of advance were likely: one northward along the Sabi and thence westward along the Mkwasine River; the other westward along the Lundi River to the Chiredzi. There was little to indicate which river was incriminated. The cattle infected were grazing within the Mkwasine basin but had, comparatively recently, been pastured in the Chiredzi drainage.

Expenditure was approved for the employment of three D.7 bulldozers to be operated by the Conservation and Extension Department. The view was expressed in various quarters that the task should be put out to private tender and not allocated to a Government Department. The clearing, however, involved close collaboration between machine operators and tsetse control staff and it was not possible to estimate costs, for the work was very different from the sheer-felling of trees on land destined for agriculture. In the first stages the project would be to some extent experimental. When, as a result of experience, data were obtained on which costings could be worked out, then consideration might be given to placing other tasks out to tender.

The first D.7 arrived on the Mkwasine River on 3rd December and a second on 20th January. Later—25th March—a D.6 became available but proved inadequate for the task. While the Mkwasine clearing was in progress, the capture of tsetse fly on the Chiredzi River in April gave a more precise indication of the direction which operations should take. It was decided to complete clearing of the Mkwasine drainage system as far as the boundary fence of the Sangwe Reserve and then transfer the machines to the Chiredzi. Work on the Mkwasine ceased on 14th July. Riverine vegetation had been cleared for eight miles of the course of the main river, west of the Sangwe boundary fence. Similar vegetation was also removed from 30 miles of tributaries entering this section of the Mkwasine. The average width of clearing is from 50 to 70 yards on each bank though on one tributary, the Madela, removal of *Acacia nigrescens* woodland has made a clearing half a mile wide. Occasional trees were left standing to act as shade trees.

The average rate of progress was 0.8 acres per hour per machine: the total area cleared was 2,165 acres at a cost per acre of just under £7 10s.

Prior to the Mkwasine clearing the area had been mapped vegetationally by Mr. J. A. Farrell who recognized 20 different vegetation communities. The map provided a guide to the machine teams and also a check on their performance.

(f) Mkwasine Hand-clearing Scheme. A further 206 acres of riverine bush were removed by felling with axes on a section of the Mkwasine River where it passes through a gorge near the boundary of the Sangwe Reserve. Here it was not possible to use machinery. The stumps of trees were covered with piles of brushwood in the hope that fire would kill them in due course. This work cost 42s. 6d. per acre.

(g) Chiredzi Mechanical Bush-clearing Scheme. Vegetation maps had been prepared from air photographs by the time this operation began in August, 1959, in the basin of Nyamasikana tributary near the Chidumo Clinic. By the end of September 690 acres had been cleared. On the first 300 acres the felled bush was also piled (at the request of the landowner) but it became clear that the extra cost of this operation was prohibitive. The clearing alone cost slightly less than on the Mkwasine River (£7 8s. per acre) but piling cost another £5 per acre.

(h) Chiredzi Hand-clearing Scheme. Some apprehension was expressed during the Mkwasine operation about the liability of the cleared land to soil erosion. It was therefore decided, in the Chiredzi operation, that the actual banks of the rivers would be cleared by hand. By the end of September 44 acres of river bank had been cleared and stumped at a cost of £10 per acre.

(i) Lundi Banks Hand-clearing Scheme. The south bank of the Lundi River opposite the Chiredzi confluence carries little riverine vegetation and in many places the mopane scrub reaches to the edge of the river bank. The removal of the narrow band of riverine thicket, where this occurs along the bank forming the northern boundary of Matibi II Reserve has been partly completed, using manual labour. It is the intention, on the Lundi itself, to avoid destruction of those portions of riverine vegetation which assume the form of gallery forest. It

is thought that sufficiently large gaps may be made to form a barrier by removal only of riverine vegetation where this comprises scrub only.

(j) Insecticide Operations. The black basalt defence zone will become increasingly efficient as vegetation suitable for the maintenance of tsetse colonies is eliminated, either by clearing for that purpose or by agricultural activities. This will take some time to complete and although irrigation projects may in time provide a barrier needing no maintenance other portions may, for many years, be liable to occasional crossing by tsetse fly. Such crossings will become apparent in trypanosomiasis infections of local cattle. These infections, in the first place, would be treated with a non-prophylactic curative drug. Failure of the disease to reappear would lead to the conclusion that infection had derived from a single sporadic appearance of tsetse and that no further action would be required. Reappearance of the disease would be due to tsetse either continuing to cross the barrier or already having established themselves near the infected area. Both these conditions have appeared during the last year. At Chilonga, in Matibi II Reserve, an infection disappeared after treatment and has not reappeared; on the Lone Star Ranch, after the initial outbreak in July, 1959, infection has been continuous although cases were not numerous. Where infection did not reappear (as at Chilonga) no further action would be taken; where it did, as in Lone Star, insecticides would be used on the assumption that tsetse had established itself.

(i) *DDT Spraying.* This was undertaken in April and consisted of the spraying from knapsack sprays with 5 per cent. DDT suspension, of 120 miles of riverine fringe, paths, pans and waterholes; 1,340 gallons of the insecticide were used. The areas treated included both banks of the Chiredzi River from Chidumo Clinic to the Lundi; the north bank of the latter to the Mahonde River and of this river, both banks. Both banks and riverine fringe of the Nyamasikana River were treated as well as all cattle, cattle paths and sledge tracks. It was while this operation was in progress that the three tsetse mentioned as captured on the Chiredzi River were taken.

(ii) *Dieldrin Spraying.* In this operation paths were cut, 40 yards apart and at right angles to the river bank, through 800 acres of thicketed woodlands on the east bank of the Chiredzi. Elsewhere, because the the bush was less dense, no paths were cut and distance between spraying machines was kept by eye. The operation took ten days, from 17th to 22nd September and from 3rd to 7th October. Ten two-stroke engine portable spray pumps were used, each with a team of two operators, two carriers and a panga man. Supervision was carried out by African Field Assistants. These ten teams worked as a unit, keeping line abreast, each at a distance of 40 yards from the team on the right. A 3.6 per cent. suspension of dieldrin was used. This was prepared in drums at the camp and transported by jeep and trailer, following the machines.

A total of 2,700 acres was sprayed, using 1,370 gallons of the suspension, thus giving a coverage of 0.6 gallons per acre. The total cost per acre including labour and fuel was 6s. 7d. During the best day's work the team of ten machines covered 465 acres.

D. Other Areas—by G. F. Cockbill, Senior Entomologist

Chipinga

There was a marked reduction in the incidence of cattle trypanosomiasis, both in the number of farms infected and the average infections per farm. Last year 171 cases were reported from 21 farms compared with 52 infections (some of them mixed) from 11 farms for the year under review. It was noted in the Annual Report for 1957-58 that the rainfall for the area during the build up of infection (January to March) was 10.79 inches greater than average and the suggestion was made that a contributory factor to the high incidence of nagana was that conditions favoured the dispersal of *G. pallidipes*. It is significant that the rainfall for the same period this year was 5.09 inches lower than average. The corollary can now be suggested that conditions less favourable to the spread of *G. pallidipes* have been accompanied by a lower incidence of trypanosomiasis.

An interesting observation has emerged from a consideration of the distribution map of the reported cases of trypanosomiasis since 1st October, 1957, Fig. 3. Cases from farms forming part of the Busi drainage system—Good Hope, Roslyn, Ratleshoek, Ravenswood and Pendragon are predominantly *T. congolense* cases. Those from farms forming part of the lower Umseleswe drainage system—Craig-

more, Umseleswe, Chikore, Hermit and Hogwhe are predominantly *T. vivax*. On the farms Lettie Swan, Umzila, Smithfield and Houtberg which are drained to some extent by both rivers, or are adjacent to the headwaters of both rivers, *T. congolense* and *T. vivax* cases occur in approximately equal numbers.

TABLE 1.—TRYPANOSOMIASIS IN CATTLE: CHIPINGA DISTRICT, 1952/1959

River System	Associated Farms	Infections 1.10.52–30.9.57			Infections 1.10.57–30.9.59		
		T. congo	*T. vivax*	*T. brucei*	*T. congo*	*T. vivax*	*T. brucei*
Lower Umseleswe	Umseleswe	—	3	—	5	13	—
	Craigmore	6	8	—	5	12	—
	Chikore	8	—	—	—	4	—
	Hogwhe	10	2	—	2	4	—
	Hermit	5	2	1	—	1	—
	Wakkerstroom	—	—	—	—	2	1
	Bamboo Creek	—	3	1	—	—	—
		29	18	2	12	36	1
Upper Umseleswe	Luiperdsvlei	—	—	—	—	1	—
	Umsasa	—	—	—	3	4	1
	Green Valley	—	—	—	2	1	—
	Smithfield	—	—	—	6	2	1
	Lizia	—	—	—	2	1	—
	Vrede	—	1	—	1	—	—
	Grassflats	—	—	—	—	1	—
	Oribi Ridge	—	—	—	1	—	—
	West Riding	—	—	—	—	2	—
	Lungile	1	—	—	—	2	—
	Houtberg	14	4	—	8	3	2
	Gambadzia	—	—	—	—	1	—
	Claremont	—	—	—	1	—	—
		15	5	—	24	18	4
Upper Umseleswe & Inyamadzi	Umzila	3	1	—	5	3	1
Inyamadzi, Busi & Umseleswe	Lettie Swan	27	1	—	15	16	1
Inyamadzi and Chiredza	Farfell	2	2	—	—	—	—
	Zona	3	6	—	—	—	—
Inyamadzi and Busi	Pendragon	6	3	—	11	1	2
Busi	Kenilworth	—	1	—	—	—	—
	Petrusville	—	—	—	1	—	—
	Hartebeeste Nek	—	—	—	2	—	—
	Heilrand	—	1	—	9	—	—
	Woodstock	2	—	—	—	—	—
	Ravenswood	—	—	—	5	—	—
	Wolfscrag	4	2	—	—	—	—
	Eastleigh	1	—	—	3	—	—
	Goodhope	4	—	—	8	—	—
	Brightside	1	—	—	1	1	—
	Sherwood	2	1	—	2	—	—
	Ratelshoek	3	—	—	3	—	—
	Roslyn	3	—	—	29	2	—
	Fallowfield	4	—	—	1	—	—
	Vaalkoppies	—	—	—	1	1	—
		24	5	—	56	4	—
Sheneke	Mt. Selinda	4	2	—	—	—	—
	Small Deel	—	—	—	—	9	2
	Gwenzi	14	2	—	—	—	—
	Emerald	12	3	—	16	9	2
		30	7	—	16	18	4
Lusito	De Rust	1	—	—	—	—	—
	Heathfield	1	—	—	—	—	—
	Mayfield	5	—	—	—	—	—
	Petronella	—	—	—	1	—	—
	Ndima	11	1	—	12	8	1
		18	1	—	13	8	1
	TOTAL	147	49	2	152	104	14
		198			270		

Table 1 summarises the distribution of trypanosomiasis in the area for the periods, 1st October, 1952, to 30th September, 1957, and 1st October, 1957, to 30th September, 1959. These periods have been chosen to emphasize the marked changes that have taken place in the recorded pattern of trypanosomiasis during the past two years. There has been an overall increase in the incidence of trypanosomiasis, due mainly to the large number of cases during 1957-58. The number of *T. congolense* cases has shown only a slight increase, but there has been a marked increase in the incidence of *T. vivax*, and particularly of *T. brucei*. The lower Umseleswe farms prior to October, 1957, recorded *T. congolense*, *T. vivax* and the only (2) cases of *T. brucei*. Subsequent to October, 1957, although the total number of infections remained the same, the number of *T. congolense* cases had dropped to less than half, and the *T. vivax* cases had doubled. One *T. brucei* infection was reported. Along the Upper Umseleswe, both *T. congolense* and *T. vivax* extended their range, and *T. brucei* occurred on three farms. Further north within the Busi drainage, the number of *T. congolense* cases more than doubled, and the few *T. vivax* occurrences remained at a low level. No *T. brucei* were recorded here.

In the drainage areas of the Lusito and Sheneke rivers running towards Portuguese East Africa there has been a decrease in the number of *T. congolense* cases and an increase in the number of *T. vivax* and *T. brucei* infections.

The extremely low incidence of tsetse in these areas make it unlikely that the relation between species of trypanosome, game and tsetse will be elucidated here, although we may note that on the Busi and Nyamadzi drainages north of Mount Selinda the common tsetses are *G. pallidipes* and *G. brevipalpis* with, rarely, *G. austeni* and *G. morsitans*. On the Umseleswe drainage no tsetse have yet been caught, but the adjacent fly belts would suggest that *G. morsitans* and *G. pallidipes*, possibly with *G. austeni*, but without *G. brevipalpis* are the responsible tsetses.

An indication was given in the Report for 1957-58 that investigations would be made on the effect of residual insecticidal spraying along the Portuguese Border in preventing movement of tsetse into the clearing during the wet months, and on the possibilities of using phytocides on certain vegetation types which are costly to control by slashing. Some progress was made on these lines.

In January a 5 per cent. dieldrin emulsion (diluted from Shell Dieldrex "15") was sprayed by means of pneumatic knapsack sprayers on to the woody vegetation along the bush edge of the Border clearing where it crosses the Chiredzi and Inyamadzi valleys, and on to woody vegetation forming the boundary of Stirling Farm within the Inyamadzi Valley. During February the spraying was extended to include part of the Busi Valley within the Border clearing and was completed by 9th March. A front of approximately ten miles was covered, using 735 gallons of insecticide. The intention was to give protection to farms adjacent to the Border clearing lying to the north of Mount Selinda, by providing an insecticidal barrier to the passage of tsetse along these watercourses from Portuguese East Africa.

The protection given by the application of insecticide might be expected to last for the three months January to March. Comparing the incidence of trypanosomiasis during January to March, 1958 (before spraying), with that during January to March, 1959 (after spraying), on protected and unprotected farms (Table 2) it is evident that spraying has been accompanied by a significant reduction in the incidence of disease.

TABLE 2.—INCIDENCE OF TRYPANOSOMIASIS CASES, CHIPINGA DISTRICT. JANUARY/MARCH, 1958, AND JANUARY/MARCH, 1959.

	Cases January to March, 1958 No Spraying	Cases January to March, 1959 After Spraying	Total
On farms protected by spraying .	44	3	47
On farms not protected	44	14	58
TOTAL	88	17	105

$\chi^2 = 4{\cdot}79$. $P > 0{\cdot}05$

After the residual effect of the insecticide had become exhausted, the incidence of trypanosomiasis on the protected farms did not differ significantly from that on the unprotected farms, emphasizing the probable effect of the spraying. (Table 3.)

TABLE 3.—INCIDENCE OF TRYPANOSOMIASIS CASES, CHIPINGA DISTRICT. APRIL/SEPTEMBER, 1958, AND APRIL/SEPTEMBER, 1959.

	Cases April to September, 1958	Cases April to September, 1959	Total
On farms protected by spraying .	48	6	54
On farms not protected	84	10	94
TOTAL	132	16	148

$\chi^2 = 0{\cdot}12$, no significance.

In view of the general reduction of trypanosomiasis in the Chipinga District this year the apparent effect of the spraying must be regarded with some reserve. However, the fact remains that trypanosomiasis did not occur on Lettie Swan or Umzila this year and was drastically reduced on Roslyn and Goodhope which are the farms for which protection was intended. By way of contrast, the farms Chikore, Craigmore, Umseleswe and Hogwhe, drained by the lower Umseleswe, which received no insecticide have shown an increase in the number of infections.

A preliminary investigation was undertaken to assess the value of organic phytocide in contributing to the control of regrowth on the Border clearing. The material used was a mixture of the butyl esters of 2,4,5-T and 2,4-D, diluted to 3 per cent. and 6 per cent a.i. in lighting paraffin, which corresponded to the formulation used by De Souza in Moçambique in bush control. Lighting paraffin, though more expensive than diesoline was preferred as it caused less rapid leaf fall, and permitted more of the applied toxin to penetrate into the plant tissues. Application was made to the foliage by means of pneumatic knapsack sprayers at 75 lb. p.s.i. Some 50 species of trees showing coppicing were treated, each with 3 per cent. and 6 per cent. mixture applied to the foliage during January, February, March and April; 23 species were cut at about 2 ft. from ground level and the cut stumps treated with the 6 per cent. mixture in January, February, March and April; corresponding trees were cut and left untreated as a control to indicate the extent of regrowth that might be expected under prevailing conditions; in February, March and April, a 6 per cent. mixture was applied to the same species of growing tree through deep cuts made into the bark and sapwood. In each treatment individual trees were labelled.

It is too early to comment on the effect of this treatment. Other workers have indicated their reluctance to comment on the results of arboricide trials until two growing seasons have intervened. However, at this stage, the indications are that *Bauhinia punctata, Diplorhynchus condylocarpon, Brachystegia spiciformis, Combretum molle, Ficus gnaphalocarpa, Harungana madagascariensis, Maytenus cymosa, Peltophorum africanum, Psidium guajava, Psorospermum febrifugum, Sclerocarya caffra* and *Terminalia brachystemma* are fairly resistant to 2,4,5-T and 2,4-D applied in this way, and that *Afrormosia angolensis, Brackenridgea zanguebarica, Burkea africana, Cassia petersiana, Lannea discolor. Lantana camara, Lippia javanica, Markhamia acuminata, Mucuna coriacea, Parinari curatellifolia, Piliostigma thonningii, Pterocarpus angolensis, Solanum aculeastrum, Strychnos spinosa, Toddalia asiatica, Triumfetta* sp., *Uapaca kirkiana, Vangueria tomentosa* and *Vernonia ampla* are likely to be susceptible. There seems to be some evidence that removal of the susceptible species from a mixed association by means of arboricides might lead to an extension of the more resistant species. This work is being continued.

Searches for tsetse on the Border clearing were made using fly-boy patrols, bait cattle, a bait pig and traps. The species recorded in this area were *G. brevipalpis, G. pallidipes, G. austeni* and *G. morsitans*. Three *G. austeni* were recorded this year, bringing a new problem to light, that of contending with this little known species.

Variations on the techniques of cutting regrowth were investigated. It was found that knocking off young regrowth of *Brachystegia spiciformis* at frequent intervals served only to stimulate the underground parts into further shoot formation, but that by chopping deeply into the underground crown of guava *(Psidium guajava)* many were killed.

It is evident that the problems of controlling regrowth, which, in this area may be regarded as partly the responsibility of this Department, and of controlling bush encroachment, which certainly is not, are growing in national importance. In many instances bush encroachment has resulted from improper farm management, and it would be uneconomic to institute control measures designed merely to kill trees while the mismanagement remains.

Sanyati (South-west Lomagundi)

There has been little change in the tsetse situation, and the situation in general remains satisfactory. Materials have been purchased for the construction of a game fence as a continuation of the main Sebungwe fenced zone.

The existence of *G. morsitans* and *G. pallidipes* on the rivers running into the Sanyati downstream from the Mongolohwe presents a threat to the recently cleared areas east of the Sanyati. One *G. morsitans* was taken on the Urungwe bank of the Sanyati at Ganderowe. Particular attention will be paid to these pockets of tsetse during the coming year.

Mtoko

There have been several staff changes in the area, and for a period from March to June hunting was suspended.

Two bait cattle kept at Border Camp contracted trypanosomiasis. One died, but the other was treated successfully, but under the conditions of extreme poverty it was eventually destroyed.

Following the discovery of cattle trypanosomiasis in the Chimanda Reserve, a patrol was carried out between the Mazoe and Ruia rivers, but no tsetse were caught or seen.

Tsetse have been taken regularly along the international boundary between the Mudzi and Ruenya rivers, and during April and May there was evidence of increased activity within the Chikwizo Reserve. During August one male *G. morsitans* was taken along the Vombosi river, which is the most westerly record, apart from the traffic control point, for some years.

Cattle at Chikwizo were maintained under drug treatment. Other cattle were introduced after having been branded and inspected for trypanosomiasis. Diseased animals were treated. The untreated cattle were used to detect the presence of any trypanosomiasis which had been masked by the overall drug treatment. The general situation is satisfactory.

North Lomagundi

There were no cases of trypanosomiasis within the Doma area, and no tsetse were caught or seen above the escarpment. Strenuous efforts were made to extend the system of roads in the area, particularly to link this area with Rekomitjie Field Station.

3. GAME DESTRUCTION

The number of game shot has gone up by about 3,000 as compared with 1958-59. It is emphasized that this does not indicate any change in the policy of replacing game destruction by other techniques of tsetse control as soon as possible. It will be seen in the Report for 1958-59 that during that year shooting in the largest operational area, Sebungwe, was only at full strength from June onwards. The increase in the Sebungwe area more than accounts for the difference in the territorial total between this year and last. It will be noted that game destruction in the Sabi West area has ceased. In the Sabi and Sebungwe areas 12-bore shotguns were used to supplement the ageing .303 rifles and were found more efficient and more economical, particularly against smaller game such as duiker, Sharpe's grysbok and steenbok. These animals, plus bushpig, account for the whole of the Sebungwe increase mentioned. Within shooting areas the policy is to confine the area of operation to the smallest area compatible with effectiveness, where possible using a fenced boundary; but within this area every effort is made to shoot efficiently and intensively in the belief that the sooner the operational area is denuded of game the sooner will it be possible to cease hunting and thus, in the long run, to reduce destruction of game to a minimum.

GAME DESTRUCTION

Larger Game		*Smaller Game and Carnivores*	
Elephant	37	Duiker	7,609
Zebra	192	Oribi	65
Buffalo	119	Steenbok	416
Tsessebe	20	Sharpe's Grysbok	506
Hartebeest	2	Bushpig	1,194
Waterbuck	68	Warthog	2,276
Reedbuck	190	Klipspringer	37
Sable	276	Suni	11

Larger Game		*Smaller Game and Carnivores*	
Roan	62	Monkey	3
Eland	48	Baboon	2,238
Kudu	1,265	Antbear	4
Bushbuck	1,104	Badger	1
Nyala	65	Porcupine	4
Impala	670	Rabbit	4
		Dassie	6
		Wild Dog	21
		Hyaena	34
		Jackal	3
		Leopard	7
		Genet	11
		Civet	4
		Wildcat	4
		Polecat	2
		Meercat	5

Larger Game	4,118	(22%)
Smaller Game and Carnivores	14,465	(78%)
TOTAL	18,583	

4. TRAFFIC CONTROL

The records of traffic and flies caught are given in Appendix I. Compared with last year, more cars carried fewer flies; fewer cyclists carried more flies, and fewer pedestrians have carried fewer flies, although in the last case rather more flies were carried per 1,000 cyclists than last year.

During the year 35 control points that were yielding very few or no flies were closed down. These gates, some of them established as very temporary check points, had served their purpose of assessing the extent to which tsetse may be carried by traffic in the area. The information gained has contributed to knowledge of the distribution of tsetse. Where the traffic cleansing points play a part in reducing the spread of tsetse, they are being maintained, but elsewhere, where their contribution to control is negligible, they have been removed and the cost of maintaining them has been applied to other forms of tsetse control.

Four new traffic control points have been established.

5. HUMAN TRYPANOSOMIASIS

There were four recorded cases of human trypanosomiasis. In the Zambezi Valley, across the river from Feira, three Africans became infected and, at Kariba, one European contracted the disease. No deaths occurred.

7. ACKNOWLEDGEMENTS

Once again we have benefited greatly by the help and collaboration of other departments: trypanosomiasis cannot be dealt with by a single organization in isolation. To a greater or lesser degree all concerned with the economic development of remote areas contribute to the solution of the tsetse problem. In various joint operations it has been a pleasure to work with officers of the Department of Veterinary Services, of the Southern Rhodesia Game Department and of the Department of Conservation and Extension.

The Department has continued to enjoy the support and encouragement of the Tsetse and Trypanosomiasis Control Committee. In various areas the co-operation of provincial and district officials and farmers in local trypanosomiasis committees has been of great value.

Finally, I have to thank all staff of the Department for a year of hard work in which their enthusiasm and interest in our task has been a great encouragement.

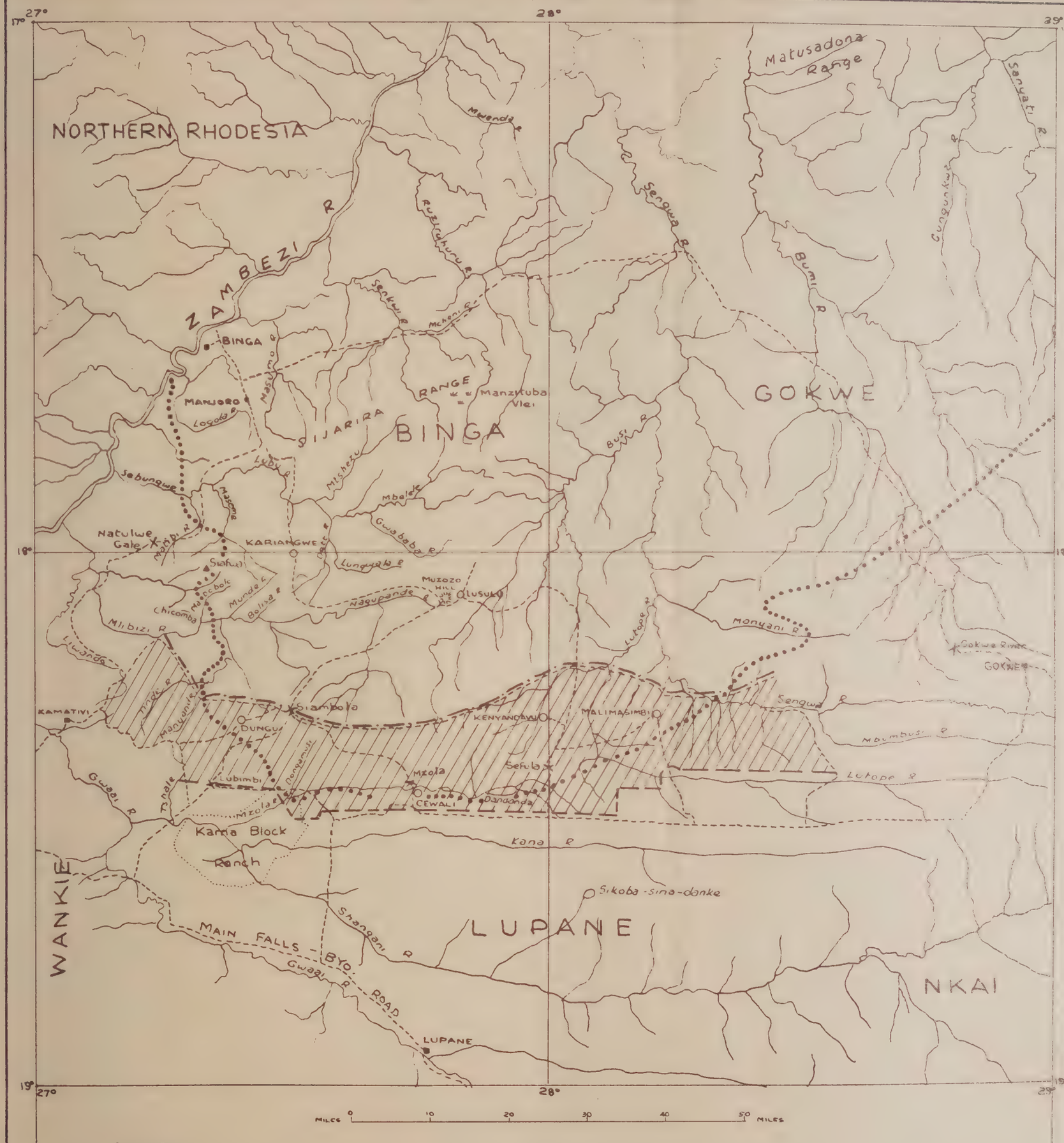
J. FORD,
Director.

District		Cars				Cycles				Pedestrians			
		No.	M	F	Total	No.	M	F	Total	No.	M	F	Total
North Urungwe . .	*m*	163,187	261	241	502	17,149	191	108	299	16,906	242	140	382
	p		16	5	21		2	4	6		4	1	5
Urungwe Native Reserve	*m*	8,011	2	—	2	12,211	11	3	14	13,189	1	3	4
Mtoko	*m*	18,781	50	42	92	4,755	8	5	13	8,851	4	7	11
Sabi East	*m*	3,082	12	4	16	22,585	790	430	1,220	104,774	989	553	1,556
	p		—	1	1		12	11	23		14 sex not recorded 30	43	73
Sabi West	*m*	1,945	—	—	—	6,959	13	2	15	13,160	13	8	21
	p		—	—	—		1	—	1		1	—	1
Chipinga	*p*	794	1	—	1	1,434	—	—	—	9,046	1	—	1
	b		1	3	4		—	—	—		1	2	3
Sebungwe	*m*	8,061	412	240	652	22,074	2,104	877	2,981	41,180	549	255	804
	p		1	3	4		2	1	3		4	—	4
Total . . .	*m*	203,861	737	527	1,264	87,167	3,117	1,425	4,542	207,106	1,798	966	2,778
	p		18	9	27		17	16	33		14 sex not recorded 40	44	84
	b		1	3	4		—	—	—		1	2	3

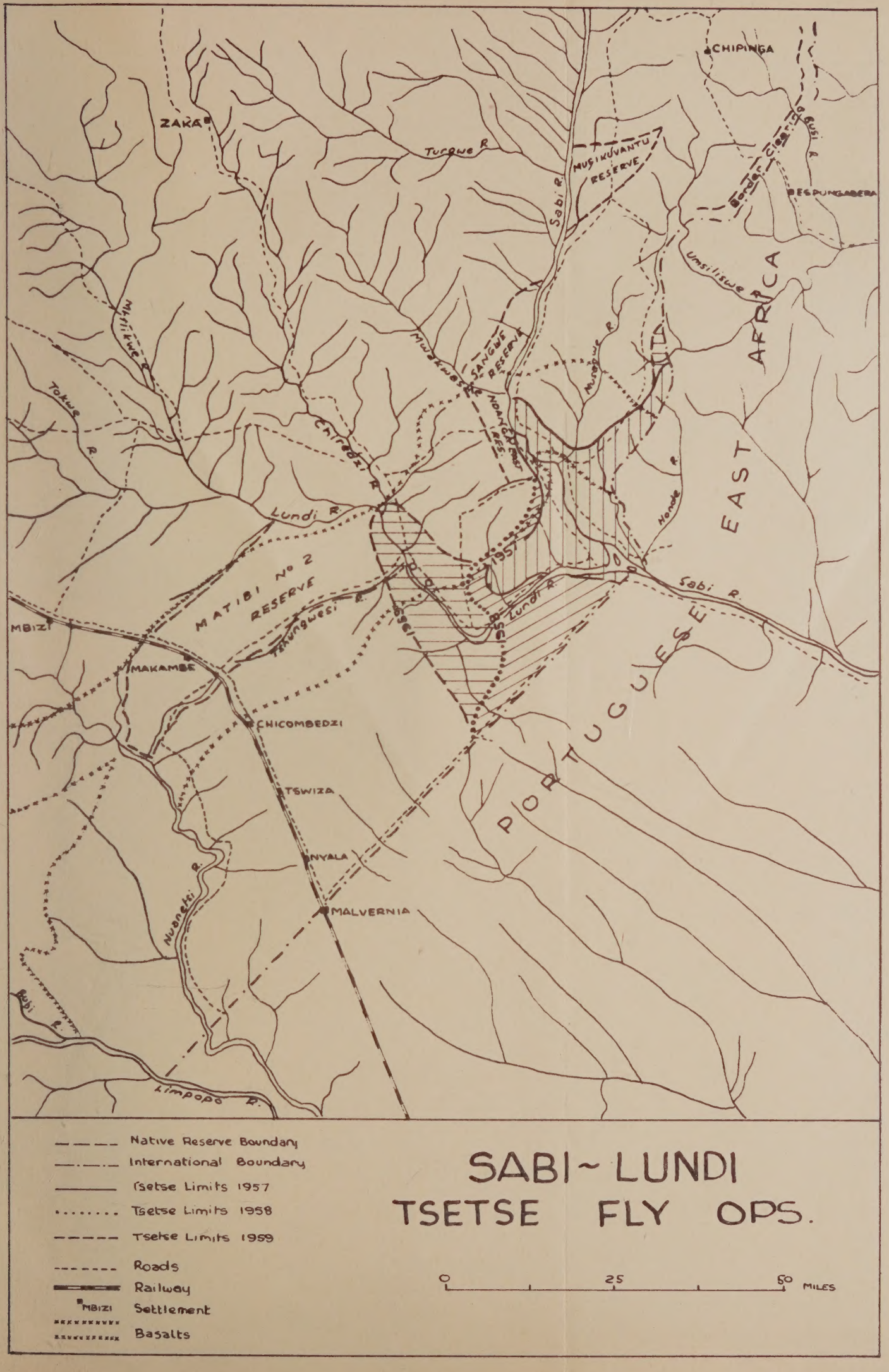
m. *Glossina morsitans*
p. *G. pallidipes*
b. *G. brevipalpis*

One female *G. austeni* was taken from eastbound traffic at Rusungwe Gate, Sabi East, in October, 1958.

30th November, 1959.



SEBUNGWE
TSETSE FLY OPS


CHIPINGA
ZAKA
Turgwe R.
Sabi R.
MUSIKUVANTU RESERVE
Gusi R.
BESPUNGABERA
Umsiliswe R.
RHODESIA
EAST AFRICA
Mutirikwe R.
Tokwe R.
MUSAKWISI R.
SANGWE RESERVE
NDANGEDZAKWE FRS.
Mutirikwe R.
Chiredzi R.
Lundi R.
Honde R.
1957
MATIBI No 2 RESERVE
Sabi R.
Lundi R.
MBIZI
MAKAMBE
CHICOMBEDZI
TSWIZA
NYALA
MALVERNIA
PORTUGUESE
Nuanetsi R.
Sabi R.
Limpopo R.
Native Reserve Boundary
International Boundary
Tsetse Limits 1957
Tsetse Limits 1958
Tsetse Limits 1959
Roads
Railway
MBIZI Settlement
Basalts
SABI~LUNDI
TSETSE FLY OPS.
0
25
50 MILES